Courses of Study

(Detailed Course Contents)

B. Tech. (Electrical Engineering)

(2019 Batch)

Shri Mata Vaishno Devi University

Kakryal, Katra 182320 Jammu & Kashmir

Head-SoEE

VISION

Establishment of a Scientific & Technical University of Excellence to nurture young and talented human resources for the service of Indian Society & world at large and preserving the integrity and sanctity of human values.

MISSION

The mission of the University is the pursuit of Education, Scholarship and Research at the highest International level of excellence.

OBJECTIVES

- Provide education and training of excellent quality, both at undergraduate and postgraduate level.
- Ensure that the University achieves and maintains an international standing in both teaching and research
- Promote study and research in new and emerging areas and encourage academic interaction of the faculty and the students at national and international levels.
- Encourage close collaboration with industry and facilitate the application of research for commercial use and for the benefit of society.

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Details of

Programme of Study

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Syllabus of Courses

Offered by

School of Electrical Engineering

Objectives
The School of Electrical Engineering has been set up to impart training of the highest standards to the students, advancement in electrical engineering academics, research and development within and in close collaboration with industry, society and leading institutions while developing visionaries who can create a better society with a passion for technology.

Programs Offered

The school currently offers a 4 year (8 semesters) B.Tech programme in Electrical Engineering. The purpose of B. Tech programme is:

- To impart program-oriented knowledge in Electrical Engineering required for solving engineering problems so as to comprehend, analyze design and create novel products and solutions for the country.
- Provide opportunities at individual level for developing a professional with an ability to apply his/her knowledge and skills for the advancement of society in Electrical Engineering.
- To address technological requirements of society through the inventions in Electrical Engineering and interdisciplinary research.
- To develop human potential to its fullest extent so that intellectually capable and competent leaders can emerge in a range of professions with special emphasis in Electrical Engineering.

POs & PEOs of Programs

Engineering knowledge
Graduates will have a thorough grounding in the key principles and practices of Electrical Engineering and will have applied their skills and knowledge of foundational principles to the design and implementation of practical systems.

Problem analysis
Graduates will be successfully employed in the Electrical Engineering and allied professions and will be actively engaged in learning, understanding and applying new ideas and technologies in the Electrical Engineering field.

Design/development of Solutions
To develop among students ability to apply in depth knowledge of one or more specializations within the relevant branch of engineering.

Conduct Investigations of Complex Problems
To develop among students the awareness of and the competence to be savvy users of latest technology in operation.

Conduct Investigations of Complex Problems
To develop among students the ability to work with others, in professional and social settings.

The Engineer & Society
To develop an understanding among students of the human, social and business context in which they will utilize their electrical engineering skills.

Environment & Sustainability
To develop a global view among students so that they can appreciate diversity in the world and in intellectual pursuits.

Individual & Team Work
To impart knowledge from other engineering programmes, required for complete understanding of multi-disciplinary applications in the field of electrical engineering.

Ethics
Develop consciousness and commitment towards professional ethics, responsibilities and norms of engineering practices so as to become good citizens.

Communication
Proficiency in communication, both verbal and written forms, to be able to compete globally, and communicate effectively on complex engineering activities.

Project Management &Finance

Demonstrate the knowledge gained in lifelong learning, and hence participate and succeed in competitive examinations, higher studies, and broadest context of technological change.

Life-Long Learning
Willingness and ability to take up administrative responsibilities involving both project and financial management confidently.

Course Structure of
B. Tech (Electrical Engineering) programme
(Entry Batch 2019 - 2023)

1st Semester						
Sr. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	MTL 1025	Engineering Mathematics-I	3	0	0	3
2	PHL 1012	Engineering Physics	3	0	2	4
3	EEL 1001	Introduction to Electrical Engineering	1	0	0	NC
4	EEL 1006	Fundamental of Electrical Engineering	3	0	2	4
5	CSL 1022	Introduction to C Programming	3	0	2	4
6	LNL 1411	Professional Communication	2	0	2	3
7	MEL 1039	Engineering Graphics with CAD	1	0	2	2
8		NSS (Non-Credit)-UGC	40 hours			
9		Induction Program	0	0	2	NC
Total Credits						**20**

2nd Semester						
Sr. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	MTL 1026	Engineering Mathematics-II	3	0	0	3
2	ECL 1010	Basic Electronics	3	0	2	4
3	MEL1012	Engineering Mechanics	3	1	0	4
4	EEL 1007	Electric Circuit Analysis*	3	0	0	3
5	CSL 1028	Programming using Python	2	0	4	4
6	PCL 1067	Discourse on Human Virtues	3	0	0	3
7	MEP 1043	Engineering Workshop	0	0	2	1
8	LNP 1412	Language Lab	0	0	2	1
Total Credits						**23**

	Semester 3				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
PCL 2042	Introduction to Logic	3	0	0	3
MTL 2023	Integral Transforms & Complex Analysis	3	0	0	3
ECL 2070	Digital Electronics	3	0	0	3
ECP 2070	Digital Electronics Lab	0	0	2	1
EEL 2321	Electrical Machine-I	3	0	0	3
EEP 2321	Electrical Machine Lab-I	0	0	2	1
EEL 2311	Electrical Measurement and Instrumentation	3	0	0	3
EEP 2311	Electrical Measurement and Instrumentation Lab	0	0	2	1
EEP 2301	Electrical Workshop Lab	0	0	2	1
EEC 2381	Summer internship-I				1
BTL 2304	Environmental Studies	3	0	0	NC
	Total Credits				**20**

	Semester 4				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
ECL 2040	Electromagnetic Field Theory*	3	0	0	3
EEL 2422	Electrical Machine-II	3	0	0	3
EEP 2422	Electrical Machine Lab-II	0	0	2	1
EEL 2412	Analog Electronics	3	0	0	3
EEP 2412	Analog Electronics Lab	0	0	2	1
ECL 2060	Microprocessors & Interfacing*	3	0	0	3
ECP 2060	Microprocessors & Interfacing Lab	0	0	2	1
EEL 2414	Signal & Systems	3	1	0	4
EEL 2413	Electric Materials	3	0	0	3
	Total Credits				**22**

	Semester 5				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
	School Elective-I	3	0	0	3
	Open Elective-II	3	0	0	3

EEL 3511	Control System	3	0	0	3
EEL 3531	Power System-I*	3	0	0	3
EEP 3531	Power System Lab-I	0	0	2	1
EEL 3541	Power Electronics*	3	0	0	3
EEP 3541	Power Electronics Lab	0	0	2	1
CSL 2031	Data Structures	3	0	0	3
CSP 2031	Data Structures Lab	0	0	2	1
EED 3990	Minor Project –I				2
EEC 3582	Summer Internship-II				1
	Total Credits				**24**

	Semester 6				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
	School Elective-II	3	0	0	3
	Open Elective-II	3	0	0	3
EEL 3632	Power System-II	3	1	0	4
EEL 3632	Power System Lab-II	0	0	2	1
EEL 3612	Electric System Design	3	0	0	3
EEL 3613	Power Plant Engineering	3	0	0	3
EEL 4711	Power Quality & FACTS	3	0	0	3
EED 3991	Minor Project –II				3
	Total Credits				**23**

	Semester 7				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
EEC 4780	Summer Internship - III				2
	School Elective-III	3	0	0	3
	School Elective-IV	3	0	0	3
	Open Elective-III	3	0	0	3
BUL 4011	Entrepreneurship Management	3	0	0	3
PCN 3079	Constitution of India	1	0	0	NC
EED 4990	Minor Project-III				4
	Total Credits				**18**

	Semester 8				
Course Code	**Course Title**	**L**	**T**	**P**	**C**
EED 4491 / EEC 4784	(Major Project + **Open Elective-IV -NC**) / Internship				**10**
	Total Credits				**10**

Note:
- *The Tutorial Classes will be additional in the following subjects and extra slot in the table will be allocated for the same.
- *Summer Training* to be done inthe summer vacation before the semester started.

List of Electives

S. No.	Course Code	Course Title	L	T	P	C
Category-I						
1	EEE 5018	Non-Conventional Energy Resources	3	0	0	3
2	EEE 5019	Electric Drives	3	0	0	3
3	EEE 5003	Electrical Machine Design	3	0	0	3
4	EEE 5004	Power System Protection	3	0	0	3
5	EEE 5005	HVDC Transmission Systems	3	0	0	3

Category-II						
1	EEE 5009	Power System Dynamics and Control	3	0	0	3
2	EEE 5001	Wind and Solar Energy Systems	3	0	0	3
3	EEE 5006	High Voltage Engineering	3	0	0	3
4	EEE 5017	Modelling and Analysis of Electric Distribution System	3	0	0	3

Category-III						
1	EEE 5007	Electrical Energy Conservation and Auditing	3	0	0	3
2	EEE 5015	Power System Optimization	3	0	0	3
3	EEE 5008	Industrial Electrical Systems	3	0	0	3

Category-IV						
1	EEE 5013	Advanced Electric Drives	3	0	0	3
2	EEE 5002	Electrical and Hybrid Vehicles	3	0	0	3
3	EEE 5016	Power System Operation & Control	3	0	0	3

Fundamental of Electrical Engineering

Course Code: EEL 1006 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. To solve the electrical circuits (DC & AC).
2. Solve and analyze the electrical circuits using network theorems and understand the behavior of AC electrical circuits and resonance.
3. To understand the three phase electrical systems and apply the concepts of measurements in measuring electrical quantities.
4. Solve and analyze the behavior of magnetic circuits and understand the concept of transformers and their applications.
5. To study the working principles of basic electrical machines including DC as well as AC machines.

Unit I

Introduction and Electrical Circuit Analysis: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation,

AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasors, Phasor representation of sinusoidally varying voltage and current

Unit II

Steady- State Analysis of Single Phase AC Circuits: Analysis of series and parallel RLC Circuits, Concept of Resonance in series & parallel circuits, bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Concept of power factor improvement and its improvement (Simple numerical problems)

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem (Simple numerical problems).

Unit III

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters & ammeters, Single phase dynamometer wattmeter, Use of shunts and multipliers (Simple numerical problems on shunts and multipliers).

Unit IV

Magnetic Circuit: Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis and eddy current losses, Magnetic circuit calculations (Series & Parallel).

Single Phase Transformer: Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Efficiency (Simple numerical problems), Introduction to auto transformer.

Unit V

DC Machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Text/ Reference Books:

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. L.S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
4. V.D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
5. B Dwivedi and A Tripathi, "Fundamentals of Electrical Engineering", Wiley India.
6. Kuldeep Sahay, "Basic Electrical Engineering", New Age International Publishers.
7. J. B. Gupta, "Electrical Engineering", Kataria and Sons.

8. C L Wadhwa, "Basic Electrical Engineering", New Age International.
9. W.H. Hayt and J.E. Kimerly, "Engineering Circuit Analysis", Mc Graw Hill.

Electrical Circuit Analysis

Course Code: EEL 1007 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the graph theory and its application in Electrical Network
2. Obtain the transient and steady-state response of electrical circuits.
3. Analyse two port circuit behavior.
4. Familiarization with network synthesis and stability of system.
5. Understand the basics and analysis for filters.

Unit I

Network Graph Theory: Concept of network graph terminology used in network graph, Relationship between twigs and links, planar and non planar graph, Tree, Property of a tree in a graph, Co-tree, Link, Basic loop and basic cut-set, Formation of incidence matrix, Cut-set matrix, Tie set matrix, Duality, Network Theorems: Reciprocity theorem, Millman's theorem, Compensation theorem, Tellegen's Theorem.

Unit II

Laplace Transformation: Definition, Inverse LT, Properties of LT, Solution of linear differential equations, Transformed circuit components representation, Independent source, Resistance, inductance and capacitance parameters, Transfer functions.

Transient Circuit Analysis: Initial conditions, Natural response and forced response, Transient response and steady state response for arbitrary inputs, Transient response of RL, RC and RLC networks.

Unit III

Two Port Networks: Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Characterization of LTI two port networks; Z, Y, ABCD, g and h parameters, Reciprocity and symmetry, Inter-connections of two port networks, Analysis of ladder networks.

Unit IV

Network Synthesis- Causality and stability, Hurwitz polynomial, Positive real function, Frequency response of reactive one ports, Synthesis of LC, RC and RL driving point immittance functions using Foster's and Cauer's methods.

Unit V

Filters- Passive and active filter fundamentals, Determination of pass and attenuation bands constant, Low pass filters, High pass filters, constant K-type filters, Band pass filters, Band stop filters, M-derived filters, lattice filters.

Text/ Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall.
2. C. K. Alexander and M. N. O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education.
3. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.
4. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
5. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education.

ELECTRICAL MACHINES-I

Course Code:EEL 2321 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. Understand the concepts of magnetic circuits.
2. Understand how a transformer is manufactured and how does it work.
3. Analyse three phase transformer and phase conversion.
4. Understand the construction and principle of operation of DC machines.
5. Analyse the differences in operation of different dc machine configurations.

Unit I

Basics of Magnetic Circuits: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; linear and nonlinearmagnetic circuits, B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; Statically and Dynamically induced EMF, Torque, Hysteresis, Core losses, Faraday's law of EMI Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Unit II

Transformer Basics: Principle construction and operation of single phasetransformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency, **Transformer Tests:** Open & Short circuit tests, Polarity test, Sumpners test,Separation of hysteresis and eddy current losses, **Parallel operation:** Parallel operation of single phase transformer, **Auto Transformers:** Construction, Principle, Applications, Comparison with twowinding transformers.

Unit III

Three Phase Transformers: Construction, various types of connection and theircomparative features**, Parallel operation:** Paralleloperation of three phase transformers, **Performance of Transformers:** Excitation phenomenon in transformers,Three phase to six phase conversion, No load and on load tap changing of transformers, Three winding transformers, Cooling methods of transformers.

Unit IV

Basic Concepts of the Rotating Electrical Machines: Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, commutator, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil, Armature winding and commutation, lap and wave windings, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Unit V

D.C. Generators & Motors: EMF equation, Working principle, Construction, Methods of excitation, voltage build-up in a shunt generator, critical field resistance and critical speed, Armature reaction, Effect of brush shift, Compensating winding, Characteristics of various types of generators, Applications D.C. Motors: Torque equation, Characteristics of various types of motors, Applications, Direct testing, Regenerative Testing, 4-point starter, 3-point starter, Speed control of series motors, Speed control of shunt motors.

Text/ Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Electrical Measurement and Instrumentation

Course Code: EEL 2311 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. To introduce the basic principles of all measuring instruments.
2. Measurement of R, L and C using different measuring instruments and understand their operation and characteristics.
3. Identify and effective use of potentiometer and instrument transformers.
4. Understand the different types of electrical and electronics measuring instruments.
5. Understand the basic concepts of smart and digital metering and measurement of other entities.

Unit I

Measurement system, Characteristics of instruments, Methods of measurement, Errors in measurement & measurement standards, Review of indicating and integrating instruments: Voltmeter, Ammeter (PMMC, moving iron and attracted disc type), Extension of range using shunt and series resistance.

Unit II

Measurement of Resistance, Inductance and Capacitance: Measurement of low, Medium and high resistances, Insulation resistance measurement (Wheat-stone's, Kelvin's, Carey Foster's bridge), AC bridges for inductance (Maxwell's, Hey's, Anderson's, Owen's Bridge) and capacitance measurement (Desaunty's, Wien's, Schering Bridge).

Unit III

Potentiometers and Instrument Transformers: Principle and operation of D.C. Crompton's potentiometer, Current and Potential transformer, Design considerations and testing.

Unit IV

Electrical and Electronics Measurements: Multi-meter, Wattmeter & energy meter, Three-phase Wattmeter, Time, Frequency and phase angle measurements using CRO, Electronic voltmeter, Digital counters, Frequency meter, Digital counters, Frequency meter, Spectrum and wave analyzer, Storage oscilloscope.

Unit V

Instrumentation: Definition, classification and selection of transducers, Strain gauges, Thermistors, Thermocouples, LVDT, Inductive & capacitive transducers, Piezoelectric and Hall-effect transducers, Measurement of motion, force, pressure, temperature, flow and liquid level.

Smart Metering: Basic concepts of smart sensors and application, Data acquisition systems, True RMS meter, Clamp meter, Digital multi-meter.

Text/ Reference Books:

1. A K Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India
2. BC Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2nd Edition
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH
4. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
5. M. Stout , "Basic Electrical Measurement", Prentice Hall of India
6. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
7. EW Golding and F.C. Widdis, "Electrical Measurement &Measuring Instrument", AW Wheeler & Co. Pvt. Ltd. India

ELECTRICAL WORKSHOP

Course Code:EEP 2301 **L-T-P: 0 - 0 - 2**

1. Introduction of Electrical Safety precautions, Electrical Symbols, abbreviations commonly used in Electrical Engg. and familiarization with tools used in Electrical Works.
2. Name of Appliance use in daily life and their power rating.
3. Making of a circuit in which bulb is getting ON/OFF by two way switch.
4. Making of circuit in which intensity of bulb gets controlled by the use of Fan Regulator.
5. Making the extension board with the help of
    i. One switch and two socket
    ii. Two socket and their individual switch
6. Making switch board that directs electricity from one or more sources of supply to several smaller region.
7. To fabricate half wave rectifiers with filters on PCB.
8. To fabricate full wave rectifiers with filters on PCB.
9. To study wire up a circuit used for Godown wiring
    i. By using two switches
    ii. By using three switches
10. Working, Maintenance and Repair of Electrical equipment i,e Electric Iron , Electric Toaster ,Water heater, Air coolers and Electric Fans etc.
11. To study and demonstrate Vp(peak voltage),Vpp(peak to peak voltage), Time, frequency and phase using CRO.
12. To study different types of earthing and protection devices e.g. MCBs, ELCBs and fuses.
13. To make the connection of fan regulator with lamp to study the effect of increasing and decreasing resistance in steps on the lamp.

ELECTRICAL MACHINES-II

Course Code:EEL 2422 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. Understand the concepts of rotating magnetic fields.
2. Understand the operation of induction machines
3. Analyse different types of single phase induction motor.
4. Understand the construction and operation of Synchronous machines.
5. Analyse the special types of electric motors.

Unit I

Fundamentals of AC machines windings: Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single- turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding,

Pulsating and revolving magnetic fields: Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current, Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Unit II

Three Phase Induction Machines: Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Cogging and crawling of induction motor**,** Generator operation: Self-excitation. Doubly-Fed Induction Machines.

Unit III

Single-phase induction motors: Constructional features, double revolving field theory, equivalent circuit, determination of parameters, Split-phase starting methods and applications.

Unit IV:

Synchronous machines

Synchronous Generator: Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance method, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Synchronous Motor: Principle of operation, effect of load on a synchronous motor, equivalent circuit and phasor diagram, power developed in synchronous motor, synchronous motor with different excitation, different torques in synchronous motor, effect of varying excitation on armature current and power factor, V-curves, Hunting, Starting methods of synchronous motor.

Unit V

Special Electric Motors: Stepper motor, Reluctance motor, hysteresis motor, Schrage motor, AC series motor, Universal Motor, etc.

Text/ Reference Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Analog Electronic

Course Code: EEL 2412 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. To learn the basic concept and the characteristics of transistors.
2. Understand the design of OP-AMP and OP-AMP based circuits.
3. A thorough understanding, functioning of OP-AMP.
4. Design sinusoidal and non-sinusoidal oscillators.
5. Know the principle of converter and PLL.

Unit I

Overview of BJT: Structure and I-V characteristics of a BJT; BJT as a switch, Small signal equivalent circuits, high-frequency equivalent circuits.

MOSFET: MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Unit II

Operational Amplifiers: Direct coupled and RC Coupled multi-stage amplifier; Differential amplifier; Internal structure of an operational amplifier, Ideal op-amp, non-idealities in an op-amp (offset voltage and current, input bias current, slew rate, gain bandwidth product), Frequency response of an operational amplifier, Power amplifier: Class A, B and C.

Unit III

Linear and Nonlinear applications of op-amp: Inverting and non-inverting amplifier, Instrumentation amplifier, Integrator, Differentiator, Active filter, Voltage regulator.
Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators, Precision rectifier, peak detector, Monoshot.

Unit IV

Feedback Amplifiers: Different feedback amplifiers, Effect of Feedback on Amplifier characteristics, Feedback configuration: Voltage series and shunt, Current series and shunt feedback configurations.

Oscillators: Condition for Oscillations, RC type Oscillators, LC type Oscillators, Generalized analysis of LC Oscillators, Hartley, Colpitts, Wein Bridge and Crystal oscillator.

Unit V

Converter: Voltage to frequency and frequency to voltage converter, D-A and A-D Converter, Clipper and clamper, ADC/DAC specification.

Phase locked loop: Principle**,** Phase detector/comparator, Voltage controlled oscillator, Application of PLL.

Text/ Reference Books:

1. A. S. Sedra and K. C. Smith, *"Microelectronic Circuits,"* New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, *"Introduction to Operational Amplifier theory and applications,"* McGraw Hill U. S., 1992.
3. Ramakant A. Gayakwad, *"OP-AMP and Linear IC's,"* Prentice Hall
4. D. Roy Choudhury, *"Linear Integrated Circuits,"* New Age International Pvt Ltd.
5. P.R. Gray, R.G. Meyer and S. Lewis, *"Analysis and Design of Analog Integrated Circuits,"* John Wiley & Sons.

Signal and Systems

Course Code:EEL 2414 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the concepts of continuous time and discrete time systems.
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.

Unit I

Introduction to Signals and Systems: Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability, Examples.

Unit II

Behavior of continuous and discrete-time LTI systems: Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Unit III

Fourier Series and Transform: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of FourierCoefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain,magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform(DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

Unit IV

Laplace and z- Transforms: Review of the LaplaceTransform for continuous time signals and systems, system functions, poles and zeros of systemfunctions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Unit V

Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: idealinterpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuousand discrete time systems. Introduction to the applications of signal and system theory: modulationfor communication, filtering, feedback control systems.

Text/ Reference Books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India,
   1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and
   Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
5. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
6. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Electric Materials

Course Code: EEL 2413 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. To introduce the basic principles atoms, energies and dielectric materials.
2. Understand the magnetic properties of materials.
3. Understand the mechanism of conduction in semiconductor.
4. Recognize the various material used in electrical application.
5. Identify and effective special purpose material in electrical industry and testing of transformer oil.

Unit I

Atomic Structure and Interatomic Bonding: Electrons in Atoms, Bonding Forces and Energies, Bonding Type of bonds.

Dielectric Materials: Dielectric properties in static field, Permittivity, Dipole moment, Polarization and dielectric constant, Electric conductivity in solid, liquid and gaseous dielectrics, Piezoelectric materials, Ferroelectric material, Pyroelectric materials, Anti-ferromagnetic materials.

Dielectric in alternating field, Leakage currents, Dielectric loss, Dielectric strength, Breakdown voltage.

Unit II

Magnetic Properties of Materials: Magnetic field, Lenz's law and induced dipole moments, Classification of magnetic materials, Special purpose materials, Feebly magnetic materials, Hysteresis loops for different ferromagnetic materials, Factor effecting hysteresis, Soft and hard magnetic materials, Ferrites, Permanent magnets

Unit III

Semiconductor Materials: Classification of material as semiconductor, Intrinsic and extrinsic semiconductors, Working application of semiconductors, Photovoltaic cell, Varistors, LCD, LDR, Advantages of semiconductor materials used in electrical industries.

Unit IV

Materials for Electrical Applications: Materials used for resistors, rheostats, heaters, Conductor materials used for overhead transmission line, underground cables, electrical machine winding, Electrical, Mechanical, Thermal and Visual properties of insulating material, Effect of moisture on insulation.

Unit V

Special Purpose Materials and Processes: Thermocouple material, Soldering materials, Fuse and contact material, Structural Materials, Refractory Materials, Radioactive Materials, Galvanization and Impregnation processes, Processing of electronic materials, Properties and applications of mineral oils, Testing of transformer oil.

Text/ Reference Books:

1. T. K. Basak, *"A course in Electrical Engineering Materials,"* New Age Science Publications.
2. A. J. Dekker, *"Electrical Engineering Materials,"* Prentice-hall, Inc.
3. C. S. Indulkar and S. Thiruvengadam, *"Electrical Engineering Material,"* S. Chand & Company Ltd.
4. N. Alagappan and N. Kumar, *"Electrical Engineering Materials,"* TTTI Madras, McGraw Hill Education.

Control System in Electrical Application

Course Code: EEL 3511 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the modelling of linear-time-invariant systems using transfer function and state space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers...

Unit I

Introduction to control problem: Industrial Control examples. Mathematical models of physical systems. Control hardware and theirmodels. Transfer function models of linear time-invariant systems.Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagramalgebra.

Unit II:

Time Response Analysis: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Unit III

Frequency-response analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stabilitycriterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequencyresponse.

Unit IV

Introduction to Controller Design: Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustnessof control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Unit V

State variable Analysis : Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of stateequations. Eigenvalues and Stability Analysis. Concept of controllability and observability.Pole-placement by state feedback.Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems.Stability of linear discrete-time systems.

Introduction to Optimal Control and Nonlinear Control: Performance Indices. Regulator problem, Tracking Problem. Nonlinear system–Basic concepts andanalysis.

Text/References:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

Power System-I

Course Code: EEL 3531 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. Understand the concepts of power systems and various power system components.
2. Understand the electrical circuit parameters of transmission lines.
3. Understand Concept of corona and Insulators
4. Understand the mechanical design of transmission line and cables.
5. Understand concepts of distribution system.

Unit I

Evolution of Power Systems: Single line diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator.

Generation of Electric Power: Conventional and Renewable Energy Sources, Distributed Energy Resources, Energy Storage.

Supply System: Different kinds of supply system and their comparison, choice of transmission voltage.

Transmission Lines: Configurations, types of conductors, resistance of line, skin effect, Kelvin's law, Proximity effect.

Unit II

Over Head Transmission Lines: Calculation of parameters of single phase, three phase, single circuit and double circuittransmission lines, Representation and performance of short, medium and long transmission lines, Ferranti effect, Surge impedance loading.

Unit III

Corona and Interference: Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference Electrostatic and electromagnetic interference with communication lines.

Overhead line Insulators: Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.

Unit IV

Mechanical Design of transmission line: Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers.

Insulated cables: Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance ofsingle phase and three phase cables, dielectric loss, heating of cables.

Unit V

Distribution Systems:

Distribution system layout, Introduction of Distribution System, Primary & Secondary distribution, Design
consideration, distribution system losses, Classification of Distributed system- Radial Ring interconnected systems, Stepped distribution.

Introduction to DC Transmission and Distribution.

Text/ Reference Books:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994
2. C.L. Wadhwa, "Electrical Power System", New age international Ltd. Third Edition
3. B. R. Gupta, "Power System Analysis and Design", Third Edition, S. Chand & Co.
4. S. Sivanagaraju & S. Satyanarayana, "Electric Power Transmission and Distribution", Pearson Education
5. W. D. Stevenson, "Element of Power System Analysis", McGraw Hill.
6. T.A. Short, "Electric Power Distribution Handbook", CRC

POWER ELECTRONICS

Course Code:EEL 3541 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. Understand the differences between signal level and power level devices.
2. Analyse controlled rectifier circuits.
3. Analyse the operation of DC-DC choppers.
4. Analyse the operation of voltage source inverters.
5. Analyse the working and operation of cycloconverter.

Unit I

Power switching devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics, Firing circuit for thyristor, Gate drive circuits for MOSFET and IGBT,Working and Characteristics of GTO, Working and Characteristics of DIAC, Working and Characteristics of TRIAC.

Unit II

AC-DC Converters (Thyristor rectifiers): Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-loadand highly inductive load, Operation and analysis of Single phase uncontrolled and controlled rectifiers with RLE load,Three-phase full-bridge uncontrolled and controlled rectifiers with R-load and highly inductive load; Estimation of RMS load voltage, RMS load current and input power factor, power factor improvement methods for phase controlled rectifiers, effect of source inductance Input current wave shape.

Unit III

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, Principle of step up and step down operation, Time ratio control for Chopper, Single quadrant DC chopper, Two quadrant and four quadrant DC choppers, analysis and waveforms at steady state.

Unit IV

DC-AC Converters (Inverter): Power circuit of single-phase voltage source inverter, Single phase half-bridge inverter, Single phase full-bridge inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage, Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages.

Unit V

AC-AC Converters : AC Voltage regulator, Single phase half wave AC voltage controller with R load, Single phase full wave AC voltage controller with R load, Single phase full wave AC voltage controller with R-L load, Single phase to single phase (circuit step-up and step-down) cycloconverter, Three-phase to single-phase (halfwave) Cycloconverter, Three-phase to three-phase (half-wave) Cycloconverter.

Text/References:

1. M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India,
2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John
Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science &
Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.
5. PS Bhimbra, "Power Electronics", Khanna Publishers, 2019.

Power System-II

Course Code: EEL 3632 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. Use numerical methods to analyses a power system in steady state
2. Evaluate fault currents for different types of faults.
3. Understand methods to control the voltage, frequency and power flow.
4. Understand the stability of synchronous grid.
5. Understand the monitoring and control of a power system.

Unit I

Representation of Power System Components: Synchronous machines, Transformers, Transmission lines, One-line diagram, Impedance and reactance diagram, Per unit system.
Symmetrical Components: Symmetrical Components of unbalanced phasors, Power in terms of symmetrical components, Sequence impedances and sequence networks (positive, negative and zero sequences).

Unit II

Symmetrical Fault Analysis: Transient if R-L series circuit, Calculation of 3-phase short circuit current and reactance of Synchronousmachine, Internal voltage of loaded machines under transient conditions.
Unsymmetrical Faults: Analysis of single line to ground fault, Line-to-line fault and Double Line to ground fault on a generators and power system network.
Formation of Zbus using singular transformation and algorithm, Computer method for short circuitcalculations.

Unit III

Load Flows: Introduction, Bus classifications, Bus admittance matrix (Y_{BUS}), Load flow equations, Loadflow solution using Gauss Siedel, Newton-Raphson method, Approximation to N-R method, Fast decoupled method.

Unit IV

Power System Stability: Stability and Stability limit, Steady state stability study, Swing equation, Transient stability studies by equal area criterion and step-by-step method, Factors affecting steady state and transient stability, Stability improvement methods, Continuation power flow analysis.

Unit V

Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing, Automatic Generation Control, Generation and absorption of reactive power by various componentsof a Power System.
Monitoring and Control: Overview of Energy Control Centre Functions: SCADA systems, Phasor Measurement Units andWide-Area Measurement Systems, State-estimation, Contingency Analysis.

Text/ Reference Books:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education.
2. T. K. Nagsarkar & M. S. Sukhija, "Power System Analysis," Oxford University Press.
3. Hadi Sadat, "Power System Analysis," Tata McGraw Hill.
4. A. J. Wood and B.F. Wollenberg, "Power Generation, Operation and Control," John Wiley & Sons.
5. O. I. Elgerd, "Electric Energy Systems Theory," McGraw Hill Education.
6. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis," McGraw Hill Education.

Electric System Design

Course Code: EEL 3612 **L-T-P: 1 - 0 - 4**

Course Outcomes:

1. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.
2. Understand various components of industrial electrical systems.
3. Analyze and selectthe proper size of various electrical system components.

Unit I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Unit II

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Unit III

Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Unit IV

Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Unit V

Industrial Electrical System Automation: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Text/ Reference Books:

1. S.L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
3. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
4. Web site for IS Standards.
5. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Power Plant Engineering

Course Code: EEL 3613 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the principles of operation for different power plants and their economics.

Unit I

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems.

Unit II

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Unit III

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Unit IV

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems.

Unit V

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text/ Reference Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

Power Quality and FACTS

Course Code: EEL 4711 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
2. Understand the working principles of FACTS devices and their operating characteristics.
3. Understand the basic concepts of power quality.
4. Understand the working principles of devices to improve power quality.

Unit I

Transmission Lines and Series/Shunt Reactive Power Compensation: Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

Unit II

Thyristor-based Flexible AC Transmission Controllers: Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Unit III

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation.
STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

Unit IV

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. DSTATCOM.

Unit V

Dynamic Voltage Restorer and Unified Power Quality Conditioner: Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering. Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.

Text/ Reference Books:

1. N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
2. K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
3. T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
4. R. C. Dugan, "Electrical Power Systems Quality", McGraw Hill Education, 2012.
5. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991.

Basic Electronics

Course Code: ECL 1010 **L-T-P: 3 - 0 - 2**

Course Outcomes:

1. To learn basic concepts of Semiconductor Devices
2. Able to understand and use BJT and MOS Devices.
3. Learn and able to apply small signal BJT and FET analysis.
4. To analyze and design rectifiers and amplifiers.
5. Able to understand advanced semiconductor devices and oscillators.

Unit I

Introduction: Semiconductor Classification, Semiconductor bonds, Energy band description, Semiconductor types, Hall effect.

Diodes: P-N junction-I/V characteristics, diode equivalent circuits, semiconductor diodes, rectifiers (efficiency, ripple factor), filters, clippers, clampers.

Unit II

Transistors: BJT construction, characteristics (cb,ce,cc), load line. BJT biasing. FET, JFET, MOSFET (Depletion and enhancement), FET biasing.

Unit III

Transistor Modeling: BJT small signal model, hybrid equivalent model,FET small signal model.

Unit IV

Amplifiers: Single stage amplifiers, voltage gain, effect of frequency on Gain, multistage amplifier.

Unit V

Oscillators: Feedback BH criteria, oscillator types, sinusoidal oscillator, Hartley oscillator, Collpitts Oscillator, Phase shift, Wein bridge oscillator, crystal oscillator.

Other Semi-conductor devices: SCR'S, Diacs, Triacs, and other thyristors, basic theory of operation, characteristics, Theory and operation of UJT

Text/ Reference Books:

1. Basic Electronics: Devices, Circuits & IT Fundamentals, Kal, PHI
2. Basic Electronics for Scientists
3. Electronic Devices & Circuits: An Introduction, Mottershead,
4. Electronic Devices & Circuits, Boylestad, Nashelky, PHI
5. Semiconductor Devices, Nandita Dass, PHI
6. Electronic Devices & Circuits, Milman & Halkias
7. Electronic Devices & Circuits, Theodore Bogart, Jr.

Programming using Python

Course Code: CSL 1028 **L-T-P: 2 - 0 - 4**

Unit I
Introduction
Introduction to importance of IDE's like Spyder (Anaconda)/PyCharm for professional programming, explore Python shell as a calculator and for inputting Python expressions directly, HelloWorld program in Python script, Python keywords and identifiers, Indentation, Comments, Data Types and Operators in Python. Comparison: arithmetic, logical, boolean, bitwise, assignment. Python: numbers, list, tuple, strings, set, dictionary, conversion between various data types.

Unit II
Basic constructs
Input and Output in Python, if-else, for loop, while loop, break, pass, continue. Creating Functions, functions with arguments, returning values form functions, lambda expressions, recursion, global and local variables. Importing other modules/packages and using their functions, creating random numbers/random-choice to create programs for simple guessing games like Rock – Paper - Scissors.
Problems on 1D/2D/3D arrays using list. Problem solving using dictionary as look-up table.

Unit III
Object Oriented Programming
Basics of Object-oriented programming: Class and Object. Defining variables and functions inside class. Creating objects, Inheritance, Multiple and Multi Level Inheritance, Function over-riding, the concept of composing objects of a different class in an object, problems on object composition.

Unit IV
GUI creation in Python
GUI creation using Python's de-facto standard GUI package like tkinter or alternative packages like wxPython, PyQt (PySide), Pygame, Pyglet, and PyGTK. Creating labels, buttons, entry (textbox), combo box, check button, radio button, scrolled text (text area), spin box, progress bar, menu bar, file dialog, tabs etc. Creating GUI simple games like Tic-Tac-Toe.

Text/ Reference Books:

1. Think Python 2nd Edition - How to Think Like a Computer Scientist, Allen B Downey,
2. O'Reilly publication.
3. Learn Python 3 the Hard Way, Zed A. Shaw, Pearson publication.
4. Head First Programming: A Learner's Guide to Programming using the Python Language, Paul Barry David Griffiths Barry Griffiths, O'Reilly publication.
5. Dive into Python 3, Mark Pilgrim, Apress publication.

Digital Electronics

Course Code: ECL 2070 **L-T-P: 3 - 0 - 2**

Unit-I

Basic concepts of Boolean Algebra: Review of number systems - Binary, Hexadecimal, conversion from oneto another, complement arithmatic, Signed and unsigned numbers and their arithmetic operations. BCD,Excess-3, Gray and Alphanumeric codes. Review of Boolean algebra, De-Morgan's Theorems, Standard Formsof Boolean Expressions, Minimization-Techniques: K-MAPS, VEM Technique, Q-M (Tabulation) method.

Unit-II

Logic Gates & families: Logic Families: TTL, MOS, CMOS, Bi-CMOS; Performance parameters of IC families:input and output loading, fan-in, fan-out, tri-state, current drive, voltage levels, noise margins, power-speedtradeoff; Unused inputs; Interfacing between logic families.

Unit-III

Combinational Logic Circuits: Problem formulation and design of Basic Combinational Logic Circuits,Combinational Logic Using Universal Gates. Basic Adders, ALU, Parity-Checkers and Generators, Comparators,Decoders, Encoders, Code Converters, Multiplexer (Data Selector), De-multiplexers

Sequential Circuits: Latches, Flip-flops (SR, JK, T, D, Master/Slave FF,) Edge-Triggered Flip-Flops, Flip-FlopOperating Characteristics, Basic Flip-Flop Applications, Asynchronous Counter Operation, Synchronous CounterOperation, Up/Down Synchronous Counters.

Unit-IV

Shift registers & Memories

Shift Register Functions, Serial In - Serial Out Shift Registers, Serial In - Parallel Out Shift Registers, Parallel In- Serial Out Shift Registers, Parallel In - Parallel Out Shift Registers, Bidirectional Shift Registers,Basics ofSemiconductor Memories, Random-Access Memories (ROM), Read Only Memories (ROMs), ProgrammableROM's (PROMs and EPROM's), PAL, PLA.

Unit-V

A/D and D/A convertor

Characteristics of ADC, Types of ADC- SAR, Dual Slope, Flash ADC. Characteristics of DAC, R-2R Ladder,Weighted Resistance Type

Circuit and electrical interfacing considerations

Transmission line effect, reflection, crosstalk, Noise sources, shielding and decoupling

Text/ Reference Books:

1. "Digital Fundamentals" by Thomas L. Floyd, Prentice Hall, Inc
2. "Digital Systems - Principles and Applications" by Tocci, R. J. and Widner, Prentice Hall,
3. Switching and finite automata theory: Z V Kohavi.–TMH
4. Digital Logic Circuit Analysis & Design, by Victor P. Nelson, H. Troy Nagle, Bill D. Carroll and J. David
5. Irwin, Prentice Hall,
6. Digital logic and computer design: M Morris Mano –PHI
7. Modern digital electronics: R.P. Jain. TMH
8. *Digital Design: Principles and Practices, by* Wakerly J F, Prentice-Hall,
9. "Digital Experiments Emphasizing Systems and Design," by David Buchla, Prentice Hall, Inc.

Electromagnetic Field Theory

Course Code: ECL 2040 **L-T-P: 3 – 0 – 0**

Unit I: Introduction
Vector Analysis, Coordinate System, Gradient, Divergence, Curl, Laplacian in rectilinear, Cylindrical, Spherical Coordinate System, Line, surface and volume integrals, Divergence Theorem, Stoke's theorem

Unit II: Time varying fields and Maxwell's equations
Introduction, The Equation of Continuity For Time-Varying Fields, Inconsistency Of Ampere's Law, Maxwell's Equation in Integral and differential form, Physical Significance of Maxwell Equation, Boundary conditions.

Unit III: ELECTROMAGNETIC WAVES
Solution For Free-Space Conditions, Uniform Plane Waves & Propagation, The Wave Equations For A Conducting Medium, Sinusoidal Time Variations, Conductors And Dielectrics, Polarization, Reflection By A Perfect Conductor Normal Incidence & Oblique Incidence, Reflection By A Perfect Dielectric — Normal Incidence & Oblique Incidence, Reflection At The Surface Of A Conductive Medium.

Unit IV: RADIATION
Potential Functions And Electromagnetic Field, Potential Functions For Sinusoidal Oscillations, Alternating Current Element, Power Radiated By Current Element, Application To Short Antennas, Radiation From A Monopole Or Dipole.

Unit V: Transmission Line
Circuit theory analysis of Transmission Line, Loss less and Lossy transmission lines, Reflection coefficient, Transmission Coefficient, VSWR, Input Impedance, Matching of Transmission Line, pulse excitation. Group Velocity and Phase velocity.

Recommended Books:

1. Fields & Wave Electromagnetics, DK Cheng
2. Electromagnetic Waves and Radiating Systems, Jordan & Balmin
3. Elements of Electromagnetics, Sadiku
4. Engineering Electromagnetics: W H Hayt & J A Buck
5. Advanced Engineering Electromagnetics: C A Balanis

MICROPROCESSOR & INTERFACING

Course Code:ECL 2060 **L-T-P: 3-0-2**

Course Outcomes:

CO1	The student will be able to analyze, specify, design, write and test assembly language programs of moderate complexity.
CO2	The student will be able to select an appropriate 'architecture' or program design to apply to a particular situation; e.g. an interrupt-driven I/O handler for a responsive real-time machine.
CO3	The student will be able to calculate the worst-case execution time of programs or parts of programs, and to design and build, or to modify, software to maximize its run time memory or execution-time behavior.
CO4	Write programs to run on 8086 microprocessor based systems.
CO5	Design system using memory chips and peripheral chips for 16 bit 8086 microprocessor.

Unit-I

Introduction to 8085 Microprocessor: Functional block diagram – Registers, ALU, Bus systems, Memory & Instruction cycles Timing diagrams, Address Decoding techniques, Addressing modes, Instruction Set, Assembly Language Programming, Interrupts-Types & handling, ISR, Stack architecture

Unit-II

Memory and Peripheral interfacing: Basic interfacing concepts - Memory space partitioning - Buffering of buses – Timing constraints - Memory control signals - Read and write cycles, Interfacing RAM, ROM, 8255PPI, Interfacing applications using 8255. Need for direct memory access - DMA transfer types

Unit-III

Intel 16 bit Microprocessor: Register organization of 8086 – Architecture - Physical Memory organization - I/O addressing capability, Addressing modes of 8086 - Instruction set of 8086 - Assembler directives and operators, Assembly language programming, Interrupt Architecture

Unit-IV

Freescale 32 bit ColdFire Processor:-Introduction to ColdFire Core, Comparison with 8085 & 8086 Architecture, Introduction to MCF5223X Microprocessor Architecture & Functional Blocks

Recommended Books:

1. Gaonkar R. S, "Microprocessor Architecture: Programming and Applications with the 8085/8086A", New Age International (P) Ltd.,
2. K. Ray, K. M. Bhurchandi – Advanced Microprocessors and Peripherals – Architecture, Programming and Interface – Tata McGraw Hill
3. "ColdFire Microprocessors & Microcontrollers" – MunirBannoura, Rudan Bettelheim and Richard Soja, AMT Publishing.
4. Douglas V. Hall, "Microprocessors and Interfacing Programming and Hardware", Tata McGraw Hill,
5. Daniel Tabak, "Advanced Microprocessors", McGraw Hill,
6. David A. Patterson, John.L.Hennessey – Computer organization and design-the hardware/software Interface- Elsevier-Morgan Kaufmann Publishers

Engineering Physics

Course Code: PHL 1012 **L-T-P: 3 - 0 - 2**

Force and electric field due to continuous charge distribution, Field lines-Flux-Gauss's Law (differential andintegral forms) and its applications, Electric potential, Work done in assembling a charge distribution.

Force Law-line current, surface current and volume current densities (Equation of Continuity), Biot-Savart law,Properties of B, Magnetic flux-Div B, Curl B, Magnetic vector potential A, Ampere's law (differential and integralrforms), Faraday's laws of electromagnetic induction, displacement current, Modified Ampere's law, Four Maxwell'sequations in differential and integrar formsı

Electromagnetic Spectrum, Brief introduction to black body radiation, Photo-electric Effect and Compton Effect,Wave particle duality (de-Broglie waves), Davisson-Germer Experiment, Concept of wave function and its physicalsignificance, Phase and Group velocities, Uncertainty Principle.

Bohr Theory of atom (with finite and infinite nuclear mass), Derivation of time dependent and time independentSchrödinger wave equations, Expectation values and operators (momentum, energy and angular momentumoperators) and commutators, Particle in a box of infinite height (One dimensional).

Free electron theory-Free electron gas, Energy levels and density of states in one dimension, Band theory ofsolids, Classification ofmetals, semiconductors and insulators on the basis of band theory.

Recommended Books:

1. Introduction to Electrodynamics, D.J. Griffiths, Pearson.
2. Electromagnetics, B. B. Laud, New Age International Publisher..
3 Ferspectives of Modern Physics, Arthur Beiser, Tata McGraw Hills,
4. Introduction to Solid State Physics, Charles Kittel, Wiley
5. Solid State Physics, S.O. Pillai, Wiley
6. Fundamentals of Physics, Resnick Halliday, Wiley

Professional Communicarion

Course Code: LNL 1411 **L-T-P: 2 - 0 - 2**

Course Outcomes:

1. Have an advance knowledge about communication skills, their evolving nature and how to use them effectively.
2. Use knowledge of technology and can use it to communicate effectively in various settings and contexts.
3. Communicate appropriately and effectively within various organizations, also with global audience in a constantly changing technological ambience and demonstrate the ability to analyze a problem and devise a solution.
4. Employ skills that are necessary for career development and also to demonstrate an ability to work with a variety of personality types.
5. Deliver effectively formal and informal oral presentations to a variety of audiences in multiple contexts.
6. Contribute ethically, responsibly, and effectively as local, national, international, and global citizen and leader

Unit 1

General Communication

Purpose of Communication; Process of Communication; Importance of Communication; The Seven C's of the Effective Communication; Differences between Technical and General Communication. Barriers to Communication and Measures to Overcome the Barriers to Communication; Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication

Unit 2

Written Communication

Email: How to write a Formal E-mail

Letter Writing Cover Letter: Format of Letter Writing: Block and Modified, etc. ; Formal and Informal Letter Writing; Formal Letter Formats

Note Making and Notice Writing: Purpose; Format; Points to remember while writing a Note and Notice. Minutes and Agendas: Difference between Minutes and Agendas; Purpose; Format; Points to remember while drafting Minutes and Agendas

Unit 3

Job Application

Resume and CVs: Contents of Good Resume; Guidelines for Writing Resume; Different Types of Resumes; Difference between CVs and Resume

Cover Letter; Reason for a Cover Letter to Apply for a Job-Format of Cover Letter; Different Types of Cover Letters

Unit 4

Report Writing

Technical Report Writing: Difference between Business Report and Engineering Report; Characteristics of writing a good report; Guidelines for Report Writing; Steps in Report Writing; Structure of Report; Types of Reports and Different Formats.

Recommended Books:

1. Raman, Meenakshi and Sangeeta Sharma. Technical Communication: Principles and Practice.Oxford University Press, 2015.
2. Choudhury, Soumitra, and Anjana Neira Dev. Business English. Pearson Publication, 2008.
3. Mukerjee, Hory S. Business Communication. New Delhi: Oxford University Press, 2013.
4. Williams, D. Communication Skills in Practice: A Practical Guide for Health Professionals.London, United Kingdom: J.Kingsley, 2007.
5. Pandey, O. N. Technical Writing. New Delhi: S.K. Kataria & Sons, 2014

Engineering Mathematics-II

Course Code: MTL 1026 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications.
2. Learn and apply the concepts of vector integral calculus for the computation of work done, circulation, and flux.
3. Formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc.
4. Learn various methods of solution of ordinary and partial differential equations.
5. Solve various partial differential equations arising in heat conduction problems and wave propagation problems.

Unit I

Vector Calculus: Beta & Gamma functions. Differentiation of vector functions of scalar variables. Gradient of a scalar field, Divergence & Curl of a vector field and their properties. Line & surface integrals. Green's theorem, Stokes' theorem & Gauss' theorem both in vector & Cartesian forms (statement only) with simple applications.

Unit II

Ordinary Differential Equation: Formation of ODE's, definition of order, degree and solution, ODE's of first order, method of separation of variables, homogenous and non-homogenous equations and their solution, exactness and integrating factor, Bernoulli's general linear ODE's of nth order, operator method, method of undetermined coefficients, method variation of parameters, solution of simple simultaneous ODE's.

Unit III

Partial Differential Equation: Formation of partial differential equations (PDE), Solution of PDE by direct integration. Lagrange's linear equation. Non-linear PDE of first order. Method of separation of variables. Heat, Wave & Laplace's equations (Two dimensional Polar & Cartesian Co-ordinates).

Text/ Reference Books:

1. E. Kreysig, Advanced Engineering Mathematics, Wiley 10th edition 2011.
2. Frank Ayres, Vector Analysis, Mc Graw Hills, 6th edition 2011.
3. T. Marsden and W.H. Freeman,VectorCalclus, Freeman, 6 edition 2011.
4. G. Simons, Differential Equations with Applications, TMH, McGraw-Hill Higher Education; 2 edition 1991.
5. S.L. Ross, Differential Equations, Wiley 3 rd edition 1984.
6. R. Zalman, A Course in Ordinary and PDEs, Academic Press, 1st edition 2014.

Engineering Mechanics

Course Code: MEL 1012 **L-T-P: 3 - 1 - 0**

Course Outcomes:

1. To acquire basic knowledge related to Forces and Equilibrium conditions.
2. To analyses various systems existing in static equilibrium, e.g., blocks, wedges, ladders, trusses, etc.
3. To understand and apply the concepts of Centroid and Moment of Inertia on areas and rigid bodies
4. To predict the effect of force on various Engineering systems in Dynamics.

Unit I

Force and Force Systems: Coplanar, Concurrent and Non-Concurrent Force Systems, Resultant and Resolutions, Forces in Space, Vectors, Operations on Force using Vectors, Moment of Force, Varignon's Theorem, Couple and Its Properties, Resultant of a Spatial Force System.

Unit II

Equilibrium-Equilibrium of a Particle, External & Internal Forces, Equilibrium of a Rigid Body, Types of Supports, Structural Members and Beams, Reactions of Beams. Properties of Lines, Areas and Solids: Centre of Gravity, Centroid of Lines (Basic and Composite Areas), Built-Up Sections, Product of Inertia, Mass Moment of Inertia.

Unit III

Trusses, Frames and Mechanisms: Connected Bodies, Two Force and Three Force Members, Trusses, Method of Joints, Method of Sections, Determinateness of Truss, Rigid and Non-Rigid Frames, Simple Mechanisms, Space Frames.

Unit IV

Friction: Type of Friction, Characteristics of a Dry Friction, Equilibrium on Rough Inclined Place, The Wedge, The Screw Jack, Journal Bearing, Axle Friction, Thrust Bearing, Disc Friction, Clutches.

Unit V

Introduction to Dynamics, Kinematics and Kinematics of Particle in Rectilinear and Curvilinear Motions, Projectile, Kinematics and Kinematics of a Rigid Body. Usage of D'Alembert's Principle, Work and Energy, Impulse and Momentum Principles.

Text/ Reference Books:

1. Jurnarkar, S.B. and Shah, H.J.–Applied Mechanics, Charotar
2. Merium and Kraige–Engineering Mechanics, John Wiley & Sons.
3. Sharma, S.M.–Engineering Mechanics, Kirti Publications, Jammu.
4. Engineering Mechanics by Huges and Martin, E.L.B.S. and Macmillan.
5. Beer and E.R. Johnstons–Vector Mechanics, McGraw-Hill, New York.

Discourse on Human Virtues

Course Code: PCL 1067 **L-T-P: 3 - 0 - 0**

Course Outcomes:

1. Understand the relevance of human values and peaceful co-existence
2. Widen their perspectives in moral decision making
3. Develop right understanding with respect to the basic aspirations of human life
4. Gain holistic understanding of the interrelatedness of individual, family, society and nature
5. Enhance clarity, assurance & purposefulness of life.

Unit I (14 Contact Hours)

1. What is Value Education?
2. Knowledge and Skill
3. Value and Virtue
4. Moral Agency and the Notion of Dharma
5. Freedom of Will and Determinism

Unit II (13 Contact Hours)

6. Understanding Human Existence: Human Being and Human Person
7. The Basic Human Aspirations: Continuous Happiness and Prosperity
8. Understanding harmony at the level of Individual, Family and Society

Unit III (13 Contact Hours)

9. Understanding harmony at the level of Nature
10. Cardinal Human Virtues such as Compassion, Wisdom, Justice, Tolerance, Non-violence, Service to Humanity with the help of suitable illustrations

Text/ Reference Books:

1. Gurucharan Das, The Difficulty of Being Good. New Delhi: Penguin Books, 1990 (Chapter 3)
2. Herry G. Frankfurt (1971). Freedom of the Will and the Concept of a Person. The Journal of Philosophy, 68 (1): 5 – 20.
3. R.R. Gaur et al, A Foundation Course in Human Values and Professional Ethics. New Delhi: Excel Books, 2006.
4. Excerpts from relevant books supplied by the instructor as and when required.

Integral Transforms & complex analysis

Course Code: MTL 2023 **L-T-P: 3 - 0 - 0**

Fourier Analysis: Periodic functions, trigonometric series, fourier series for functions with period 2Π, complex form of the series, functions with arbitrary period, even and odd functions, half range series, approximation by trigonometric polynomials, square error, Bessel's inequality, Parseval's identity, Fourier integral.

Laplace Transforms: Function of bounded variation, laplace transform of I, tn, eat, sin(at), cos(at), sinh(at), cosh(at), erf(t), shifting properties, expressions with proofs for:
1. L{tn f(t)} 2. L{f(t)/t} 3. L{∫f(u) du}
Unit step functions, Heaviside, direct functions and their Laplace transformation, Laplace transform of periodic function.
Evaluation of inverse Laplace transform, partial fraction method, Heaviside development, convolution theorem.
Application to solve initial and boundary value problems involving the ordinary differential equation with one dependent variable.

Complex Analysis: Curves and regions in complex plane, complex functions, analytic functions, Cauchy-
Riemann equations, Laplace equations. Rational, exponential, trigonometric, hyperbolic functions, derivatives of analytic functions, Power series, Taylor series, Laurent series, zero and singularity behaviour of f(z) at infinity.

Text/ Reference Books:
1. Advanced Engineering Mathematics, Kreysig, Wiley
2. Advanced Mathematical Analysis, Malik & Arrora , S. Chand & Co.
3. Advanced Differential Equations, M.D.Rai Singhaniya S. Chand & Co.
4. Complex Analysis., M.R.Spiegel, Schuam's out line Series
5. Higher Engineering Mathematics , B.S. Grewal , Khanna Publisher
6. Advanced Engineering Mathematics E. Kreyszig, New Age International

Environmental Studies

Course Code: BTL 2304 (NC) **L-T-P: 3 - 0 – 0**

The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for publicawareness. Natural Resources, Renewable and non-renewable resources, Natural resources and associatedproblems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Landresources.

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in theecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Forest ecosystem,Grassland ecosystem, Desert ecosystem.

Environmental Pollution: Definition, Causes, effects and control measures of Air pollution, Water pollution,Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management:Causes, effects and control measures of urban and industrial wastes.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problemsrelated to energy, Water conservation, Resettlement and rehabilitation of people; its problems and concerns.

Human Population and the Environment: Population growth, Environment and human health, HumanRights, Value Education, Women and Child Welfare, Role of information Technology in Environment and humanhealth.

Field Work (Practical).
- Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Introduction to Logic

Course Code: PCL 2042 **L-T-P: 3 - 0 - 0**

The course aims to introduce students to the basic tenets of sentential and predicate logic. It shows how toformalize information and symbolize them as logical statements. It also shows how to reason systematicallywith this information to produce conclusions which are logically acceptable.

Course Content:
Propositional Logic - Truth and Validity, Inductive and Deductive Arguments, Simple and CompoundStatements, Truth Functionality, Decision Procedures, Truth Tables, Inter-definability, Proof Construction

Syllogistic Logic - Categorical Propositions, Squares of Opposition, Categorical Syllogisms, ExaminingSyllogisms

Informal Fallacies and Mill's Method - Classification of Fallacies , Fallacies of Relevance and Defective ,Induction, Fallacies of Presumption and Ambiguity, Mills Method

Predicate Logic - Singular Propositions and General Propositions, Quantification, Symbolization, Provingvalidity and invalidity

Recommended Bookss:
1. *Introduction to Logic* by Irving M.Copi
2. *Symbolic Logic* by Irving M. Copi

Entrepreneurship Management

Course Code: BUL 2011 **L-T-P: 3 - 0 - 0**

Entrepreneurial culture - establishing entrepreneurial system - idea processing, personal, financial informationand intelligence - rewards and motivation - concept bank - role of industrial fair - Theories of entrepreneurship- entrepreneurial traits - types of entrepreneurs - behavioural patterns of entrepreneurs – entrepreneurialmotivation. Business proposals: Pre-feasibility study - criteria for selection of product - ownership – capitalbudgeting - project profile preparation - matching entrepreneur with the project - feasibility report preparationand evaluation Entrepreneurship Development ; resources and capabilities; resource type; environment ofentrepreneurship development ;technological ,social, macro and micro economic factors, competition,ecological aspects etc. entrepreneurial strategies; E–entrepreneurship; Intrapreneurship; business modelsand strategies; venture capital financing; Industry innovation problems, new and emerging businessopportunities in global dynamic environment. Ethical decision making, ethical dilemmas. Construction ofbusiness plans. Entrepreneurship development programs in India - training institutions - institutions provided
technical, financial marketing assistance - role of consultancy organizations.

Recommended Bookss:

1. Dollionger "Entrepreneurship Development", Pearson (Latest Edition).
2. Vasant Desai "Dynamics of Entrepreneurship Development in Mgt", Himalaya (Latest Edition).
3. Charantimath P.M. "Entrepreneurship Development in Small Business Enterprises", Pearson (Latest Edition).
4. Saji Kumar "Impact of Globalisation on SMEs Industries", ICFAI (Latest Edition).
5. Singh B.N.T. "Industrial Development under Structural adjustment Programme", D.D. Publication.
6. Bhatia B.S. and Batra G.S. "Entrepreneurers and Small Business Management", D.D. Publisher.

Data Structure using C

Course Code: CSL 2031 **L-T-P: 3 - 0 - 2**

Course Outcomes:

CO1	To impart the basic concepts of data structures and algorithms.
CO2	To understand concepts about searching and sorting techniques.
CO3	To Understand basic concepts about stacks, queues, lists, trees and graphs.
CO4	To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Unit 1
Introduction to programming methodologies and design of algorithms. Structured programming concepts Study and implementation of basic data structures like: Arrays, multidimensional arrays and their organization, introduction to sparse arrays

Unit 2
Linked list (singly, doubly and circular)

Unit 3
Stacks, Queues

Unit 4
Searching: Sequential and binary searching.

Unit 5
Sorting: Insertion, selection, shell, merge and quick sort

Unit 6
Introduction to trees and graphs and traversal methods.

Unit 7
Introduction to Files

List of Experiments
1. Implementation of Strings (with and without using functions)
2. Implementation of stack and its operations
3. Implementation of Q and its operations
4. Array and dynamic implementation of linked list and its operations

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