SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, Tirupati

**Department of Electrical and Electronics Engineering**

**Supporting Document for 1.1.2**

# Syllabus Revision carried out in 2019

## Program: B.Tech.- Electrical and Electronics Engineering

## Regulations : SVEC-19

*This document details the following:*

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

**Note:** *For SVEC-19 revised syllabus, SVEC-16 (previous syllabus) is the reference.*

# List of Courses where syllabus content has been changed (20% and more)

| S. No. | Course Code | Name of the course | Percentage of content changed | Page Number in which Details are Highlighted |
|---|---|---|---|---|
| 1. | 19BT10201 | Basic Electrical and Electronics Engineering | 100 | 2 |
| 2. | 19BT10231 | Basic Electrical and Electronics Engineering Lab | 100 | 4 |
| 3. | 19BT20201 | Electric Circuits | 20 | 6 |
| 4. | 19BT20231 | Electric Circuits Lab | 33 | 10 |
| 5. | 19BT30201 | Electrical Machines-1 | 40 | 13 |
| 6. | 19BT30231 | Electrical Machines-1 Lab | 50 | 18 |
| 7. | 19BT30232 | Signals and Networks Lab | 34 | 22 |
| 8. | 19BT40202 | Electrical Machines-2 | 60 | 27 |
| 9. | 19BT40204 | Transmission and Distribution | 20 | 33 |
| 10. | 19BT40231 | Digital Electronics Lab | 100 | 38 |
| 11. | 19BT40232 | Electrical Engineering Workshop | 100 | 40 |
| 12. | 19BT40233 | Electrical Machines-2 Lab | 67 | 42 |
| 13. | 19BT315AC | Design Thinking | 100 | 46 |
| 14. | 19BT1AC01 | Spoken English | 100 | 50 |
| 15. | 19BT1BS02 | Biology for Engineers | 100 | 52 |
| 16. | 19BT1HS01 | Communicative English | 20 | 54 |
| 17. | 19BT1BS03 | Engineering Physics | 40 | 58 |
| 18. | 19BT1BS31 | Engineering Physics Lab | 30 | 64 |
| 19. | 19BT1BS04 | Engineering Chemistry | 50 | 68 |
| 20. | 19BT1BS32 | Engineering Chemistry Lab | 25 | 74 |
| 21. | 19BT2BS02 | Applied Physics | 100 | 78 |
| 22. | 19BT2BS31 | Applied Physics Lab | 100 | 80 |
| 23. | 19BT2BS01 | Transformation Techniques and Linear Algebra | 20 | 82 |
| 24. | 19BT4BS01 | Material Science | 100 | 87 |
| 25. | 19BT4HS05 | Gender & Environment | 100 | 90 |
| 26. | 19BT4HS09 | Life Skills | 100 | 93 |
| 27. | 19BT4HS11 | Professional Ethics | 100 | 95 |
| 28. | 19BT4HS12 | Women Empowerment | 100 | 97 |
| 29. | 19BT40107 | Sustainable Engineering | 100 | 100 |
| 30. | 19BT10341 | Basic Civil and Mechanical Engineering | 100 | 103 |
| 31. | 19BT10501 | Programming for Problem Solving | 100 | 106 |
| 32. | 19BT10531 | Programming for Problem Solving Lab | 100 | 108 |
| 33. | 19BT50409 | Green Technologies | 35 | 110 |
| | | Average %**(A)** | 71.03 | |
| | | Total No. of Courses in the Program **(T)** | 48 | |
| | | No. of Courses where syllabus (more than 20% content) has been changed **(N)** | 33 | - |
| | | Percentage of syllabus content change in the courses **(C)=(A x N)/100** | 23.44 | |
| | | **Percentage of Syllabus Content changed in the Program (P)= C/T** | **48.83** | |

**DEAN (Academics)**
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SREE VIDYANIKETHAN ENGINEERING COLLEGE
Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

**PRINCIPAL**
PRINCIPAL
SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, A. RANGAMPET
Chittoor (Dist.) - 517 102, A.P., INDIA.

**I B. Tech. – I Semester**

(19BT10201) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

(Common to EEE, ECE & EIE)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES:**--

**COURSE DESCRIPTION:** Principles of Electrical Systems; AC Machines; Semiconductor Devices andOp-Amps.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Analyze electrical circuits by applying the conceptual knowledge of circuit elements.

CO2. Demonstrate knowledge on various generation technologies, protection devices, safety procedures and BEEstandards.

CO3. Demonstrate knowledge on characteristics and applications of transformers and ACmachines.

CO4. Demonstrate knowledge on characteristics and applications of diode, BJT and Op- amps.

**DETAILED SYLLABUS:**

**Unit-I: Principles ofElectricalSystems-I**
**(9Periods)**

Basic electrical sources: DC-Battery, AC sources–Single loop generator; Single phase and three phase supply; Electrical circuit elements (R, L and C), Ohm's law, Kirchhoff's laws, Representation of sinusoidal waveforms, peak and RMS values, phasor representation, reactive power, apparent power, real power, energy and powerfactor.

**Unit-II: Principles ofElectricalSystems-II (9Periods)**

Significance of Power factor and power factor correction, most economical power factor. Typical layout of electrical grid; Typical layout and operation

of Hydro, Thermal and Solar Power Plants; Fuse, circuit breaker (MCB, MCCB, RCCB, ELCB), relay (elementary treatment); Inverter and UPS (block diagram approach only). Earthing – importance of earthing, pipe earthing and plate earthing; Safety measures. Energy Efficiency (Star rating) standards by BEE.

**Unit-III: Transformers andACMachines (9Periods)**

Construction and working of a single phase transformer, EMF Equation; Construction and working of three phase induction motor, torque equation, torque-slip characteristics, applications; construction and working of a resistor start &capacitor start and run single phase induction motor, applications; Construction and working of synchronous machine, applications.

**UNIT-IV:SemiconductorDevices (10Periods)**

PN Junction diode, Characteristics, applications - half wave and full wave rectifier. Zener diode, characteristics, application–Regulator. BJT-operation, configurations, characteristics, applications - switch and amplifier.

**UNIT-V:Op-Amps (8 Periods)**

Operational Amplifier: Block diagram of Op-Amp, equivalent circuit, Op-Amp AC and DC Characteristics, Inverting and Non-Inverting modes. Applications - Adder, Comparator, Integrator and Differentiator.

**Total Periods: 45**

**TEXT BOOKS**:


1. AshfaqHussain, *Fundamentals of Electrical Engineering,* Dhanpatrai& Co. (P) Ltd., *3rd*edition, New Delhi,2009.
2. R. L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuits*, PHI, 11th edition,2009.


**REFERENCE BOOKS**:


1. M. S. Naidu, S. Kamakshaiah, *Introduction to Electrical Engineering* ,Tata McGraw-Hill Education, New Delhi,2007.
2. D. Roy Chowdhury, *Linear Integrated Circuits*, New Age

International Pvt. Ltd., 4th edition,2011.

## I B. Tech. – I Semester

(19BT10231) **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

(Common to ECE, EEE & EIE)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:** Physics at intermediate level.

**COURSE DESCREPTION:** Practical investigations on Electrical circuits, AC Machines, Semiconductor Devices and Op-Amps.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Analyze, measure, interpret and validate the practical observations by applying the fundamental knowledge of electrical circuits, machines and electronicdevices.

CO2. Design Op-amp based amplifier, voltage summer and integrator circuits for desired specifications.

CO3. Work independently and in teams to solve problems with effective communication.

**List of Experiments:**

Minimum Ten experiments are to be conducted.

1. Measurement of electrical quantities (AC & DC) using Voltmeter, Ammeter and Wattmeter.
2. Verification of Ohm's law and Kirchhoff'slaws.
3. Circuit
   (a) With one lamp controlled by one switch and provision of 2-pin or 3-pin socket PVC surface conduitsystem.
   (b) With two lamps controlled by two switches with PVC surface conduitsystem.
   (c) For Stair case wiring and Godownwiring.

4. Measurement of Power factor and it'simprovement.
5. Load test on 1-Phase Transformer.
6. Brake test on 3-Phase InductionMotor.
7. Brake test on 1- phase inductionmotor.
8. VI Characteristics of PN and ZenerDiodes.
9. Ripple factor and load regulations of rectifier with and withoutfilters.
10. Input and output characteristics of CE configuration.
11. Design of inverting and non-inverting amplifiers usingop-amp.
12. Design of voltage summer and integrator usingop-amp.
13. Solderingpractice.

**REFERENCES BOOKS/ LAB MANUALS:**


1. P. S. Dhogal, *Basic Practicals in Electrical Engineering*, Standard Publishers,2004.
2. YannisTsividis, *A First Lab in Circuits and Electronics*, Wiley, 1st edition,2001.


**ADDITIONAL LEARNING RESOURCES:**

1. www.vlab.co.in, Virtual Electric Circuits Lab, A initiative of MHRD underNMEICT.
2. www.vlab.co.in, Basic Electronics Lab, A initiative of MHRD underNMEICT.
3. https://nptel.ac.in/courses/117106108/
4. https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/
5. https://nptel.ac.in/courses/108105017/
6. https://nptel.ac.in/courses/108108112/
7. https://nptel.ac.in/courses/117107094/

## I B. Tech. – II Semester

(19BT20201) **ELECTRIC CIRCUITS**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 1 | - | 4 |

**PRE-REQUISITES:** Physics at Intermediate Level.

**COURSE DESCRIPTION:** Circuit reduction and analyzing techniques; Analysis of single and poly phase circuits; Circuit theorems; Magnetically coupled circuits and Two-Port networks.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Analyze and solve various DC, single phase, poly phase and coupled circuits by applying the conceptual knowledge of network reduction, analyzing techniques and theorems.

CO2. Design the components for resonant circuits and passive filters to meet the specified needs.

**DETAILED SYLLABUS:**

**UNIT-I: FUNDAMENTALS OFELECTRICCIRCUITS** **(9 Periods)**

Basic definitions of network, circuit, node, branch and loop; network reduction techniques-series, parallel, series-parallel circuits, current division and voltage division rules; source transformation, wye-to-delta and delta-to-wye transformations; nodal analysis and super node concept, mesh analysis and super mesh concept – numerical problems with dependent and independent AC & DC sources.

**UNIT-II: ANALYSIS OF SINGLE PHASE AND THREE PHASE AC CIRCUITS**

**(12 Periods)**

Peak factor and form factor for different wave forms; Analysis of single phase AC circuits: impedance and admittance, impedance triangle; Power triangle; Sinusoidal response of R, L and C elements with different combinations; Resonance, bandwidth and quality factor for series and parallelnetworks.

Analysis of three phase balanced and unbalanced systems; Measurement

of active and reactive power in balanced and unbalanced systems-single wattmeter and two wattmeter methods.

**UNIT-III:CIRCUITTHEOREMS(10Periods)**

Superposition, Thevenin's, Norton's, Maximum power transfer, Millmann's, Telligen's, Compensation and Reciprocity theorems for DC & AC Excitations (without proof); Concept of dual and duality – Numerical problems.

**UNIT-IV: MAGNETICALLYCOUPLEDCIRCUITS(6Periods)**

Coupled circuits-self and mutual inductance, coefficient of coupling, DOT convention; series and parallel connection of coupled coils, equivalent circuits of coupled coils; energy in coupled circuit; analogy between electrical and magneticcircuits.

**UNIT-V:PASSIVEFILTERS (8 Periods)**

Classification of filters, filter networks, analysis of filter networks - attenuation, phase shift, characteristic impedance in pass band and stop band, constant-*K* low pass & high pass filters, *m*-derived filters, band pass & band elimination filters. Design of filters

**Text BOOKS**


1. Charles K. Alexander, Mathew N O Sadiku, *Fundamentals of Electric Circuits*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi,2013.

2. A. Sudhakar, Shyammohan S Palli, *Circuits and Networks Analysis and Synthesis*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi,2015.


**REFERENCE BOOKS:**


1. J. A. Edminister, M. D. Nahvi, *Theory and Problems of Electric Circuits*, 4th edition, Schaum's outline series, McGraw Hill, New Delhi,2004.

2. W. H. Hayt, J E Kemmerly, S M Durbin, *Engineering Circuit Analysis*, 8th edition, McGraw Hill, New Delhi,2008.

I B. Tech. - I Semester

(16BT10201) **ELECTRIC CIRCUITS**

**PREREQUISITES:** Physics at Intermediate Level

**COURSE DESCRIPTION:**

Fundamentals of electric circuit parameters; nodal and mesh analysis; analysis of single phase and polyphase systems; analysis of coupled circuits; network theorems.

**COURSE OUTCOMES:**

On successful completion of the course, students will be able to:
CO1. demonstrate knowledgeon

- voltageandcurrentrelationshipsforvariouselectric elements
- network reductiontechniques
- concepts of 1-phase and 3-phase electriccircuits
- concepts of magnetically coupledcircuits
- various circuittheorems

CO2.analyze electric and coupled circuits with conventional concepts andtheorems
CO3.design resonant circuits to meet the required specifications
CO4.evaluate electric and magnetically coupled circuitsparametersusingconventionaltechniquesandtheorems.

**DETAILED SYLLABUS:**

**UNIT-I: FUNDAMENTALS OF ELECTRICAL CIRCUITS (13 periods)**

Conceptsofcharge,current,voltage,powerandenergy;Basic definitions of network, circuit, node, branch and loop; circuit elements–classifications;Ohm'slaw,Kirchhoff'slaws;network reduction techniques-series, parallel, series-parallel circuits, source transformation, wye-to-delta and delta-to-wye transformations;currentdivisionandvoltagedivisionrules;nodal analysisandsupernodeconcept,meshanalysisandsupermesh concept –problems.

**UNIT-II: SINGLE PHASE AC CIRCUITS (13 periods)**

Fundamentals of AC quantities; average and effective values ofperiodicwaveforms;representationofelectricalquantitiesin sinusoidsandphasors,phasorrelationshipsforcircuitelements; impedanceandadmittance,impedancetriangle;instantaneous andaveragepower,powertriangle;SinusoidalresponseofR,L and C elements with different combinations; current locus; Resonance,bandwidthandqualityfactorforseriesandparallel networks –problems.

**UNIT-III: CIRCUIT THEOREMS (10 periods)**

Superposition,Thevenin's,Norton's,Maximumpowertransfer, Millmann's,ReciprocityandCompensation,Tellegen'stheorems forDC&ACExcitations(withoutproof)–problems.Conceptof dual andduality.

**UNIT-IV: THREE PHASE AC CIRCUITS (11 periods)**

Introduction to polyphase system and its advantages; phase sequence; analysis of three phase balanced and unbalanced systems;measurementofactiveandreactivepowerinbalanced andunbalancedsystems–problems.

**UNIT-V: MAGNETICALLY COUPLED CIRCUITS(08periods)**

Coupled circuits-self and mutual inductance, coefficient of coupling, DOT convention; series and parallel connection of coupled coils, equivalent circuits of coupled coils; energy in coupledcircuit;analogybetweenelectricalandmagneticcircuits – problems.

**TEXT BOOKS**


1. CharlesK. Alexander,MathewNOSadiku,*Fundamentalsof ElectricCircuits*,McGrawhilleducation(India)Pvt.Ltd,New Delhi, 5th edition,2013.
2. A.Sudhakar,ShyammohanSPalli,CircuitsandNetworks Analysis and Synthesis, McGrawHill company, New Delhi 5th edition,2015.


**REFERENCE BOOKS:**


1. J.A.Edminister, M.D.Nahvi, *Theory and Problems of Electric Circuits*,Schaum'soutlineseries,TataMcGrawHillCompany, New Delhi, 4th edition,2004.
2. WHHayt,JEKemmerly,SMDurbin,*EngineeringCircuit Analysis*,TataMcGrawHillpublishingcompanyLtd.,New Delhi, 6th edition, 2008.

## I B. Tech. – II Semester

(19BT20231) **ELECTRIC CIRCUITS LAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:** Physics at Intermediate Level.

**COURSE DESCRIPTION:** Practical investigations on DC, single and poly phase circuits, Circuit theorems, magnetically coupled circuits and Two-Port networks.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Analyze, measure, interpret and validate the practical observations by applying the conceptual knowledge of electricalcircuits.

CO2. Design resonant and Two-port networks meeting the specified needs using electrical circuitconcepts.

CO3. Work independently and in teams to solve problems with effective communication.

**List of Experiments:**

Minimum Ten experiments are to be conducted.

1. Analysis of Series and Parallelcircuits.
2. Mesh and nodalanalysis.
3. Analysis of RL, RC and RLCcircuits.
4. Current locus diagram of RL and RCcircuits.
5. Analysis of Series and Parallelresonance.
6. Measurement of active and reactive power in three phasecircuits.
7. Verification of Superposition and Reciprocitytheorems.
8. Verification of Thevenin's and Norton'stheorem.

9. Verification of Maximum Power transfer theorem for DC & ACexcitations.

10. Determination of self and mutual inductance and coefficient ofcoupling.

11. Design and analysis of Low passfilter.

12. Design and analysis of High passfilter.

**Reference Books/ Lab Manuals:**


1. P. S. Dhogal, *Basic Practicals in Electrical Engineering*, Standard Publishers,2004.

2. YannisTsividis, *A First Lab in Circuits and Electronics*, Wiley, 1st edition,2001.


**ADDITIONAL LEARNING RESOURCES:**

1. www.vlab.co.in, *Virtual Electric Circuits Lab*, A initiative of MHRD underNMEICT.

2. https://nptel.ac.in/courses/117106108/

   https://ocw.mit.edu/high-school/physics/exam-prep/electric-circuits/

I B. Tech. - I Semester

(16BT10231) **ELECTRIC CIRCUITS LAB**

| Int.Marks | Ext.Marks | TotalMarks | L | T | P | C |
|---|---|---|---|---|---|---|
| *50* | *50* | *100* | *-* | *-* | *3* | *2* |

**PREREQUISITES: - COURSEDESCRIPTION:**

Verification of Ohm's law, KVL, KCL and network theorems; analysis of AC and DC circuits; determination of resonant frequencyinseriesandparallelRLCcircuits;determinationof selfandmutualinductancesincoupledcircuits;

**COURSE OUTCOMES:**

Aftersuccessfulcompletionofthecourse,studentwillbeable to:

CO1. demonstrate knowledge on

- identification of various circuit elements and their values.
- concepts of electrical and magneticcircuits.

CO2. analyzeand relate physical observations and measurementsinelectriccircuitstotheoreticalprinciples andtheorems.

CO3. design circuit parameters to meet the required specifications

CO4. demonstrate skills in

- obtainingthecurrentlocusdiagrams.
- determiningtheparametersofmagneticallycoupled circuits.
- measuringofactiveandreactivepowers.

CO5. function effectively as an individual and as a member in ateam

CO6. communicate effectively both oral and prepare laboratoryreports.

**DETAILED SYLLABUS:**

**LIST OF EXPERIMENTS:**

1. VerificationofOhm'sLawandKirchhoff'sLaws
2. VariationofResistanceofConductorwithtemperature
3. PhasoranalysisofRL,RCandRLCcircuits
4. AnalyzingtheseriesRL,RCandRLCcircuitsforvarious excitationsystems
5. CurrentlocusdiagramofRLandRCseriescircuits
6. SeriesandParallelresonance
7. VerificationofSuperpositionandReciprocitytheorems
8. VerificationofThevenin'sandNorton'stheorem
9. VerificationofMillmann'sandCompensationtheorems
10. VerificationofMaximumPowertransfertheoremforDC & ACexcitations
11. Measurementofactiveandreactivepowerinthreephase circuits
12. Determination of self and mutual inductance and coefficient ofcoupling
13. Determination of equivalent inductance for aiding and opposing fluxes.

*II B. Tech. – I Semester*

**(19BT30201) ELECTRICAL MACHINES-1**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 1 | - | 4 |

**PRE-REQUISITES:**

Basic Electrical and Electronics Engineering and Electric Circuits.

**COURSE DESCRIPTION:**

Construction, operation, types, performance characteristics and applications of DC machines and transformers.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. analyse the DC generator to evaluate various operating parameters and develop constructional features for sustainability.

CO2. analyse the operational characteristics of various DC generators to assess measures for sustainability.

CO3. analyse the performance characteristics of various types of DC motors to develop accessories and assess the suitability for industrial applications.

CO4. analyse the equivalent circuits of transformers with various configurations to determine their performance and assess sustainability for various load conditions.

**DETAILED SYLLABUS:**

**UNIT-I:DCGENERATORS** **(9Periods)**

Principle of operation and constructional details of DC generator. Armature windings — lap and wave, simplex and multiplex, single layer and multi-layer, equalizer rings and dummy coils.EMF equation and methods of excitation. Losses — constant, variable and minimization of losses.

Calculation of efficiency — condition for maximum efficiency.

**UNIT-II: ARMATURE REACTION, COMMUTATION AND CHARACTERISTICS*(9 Periods)***

Armature reaction — cross magnetizing and de-magnetizing AT/pole; compensating winding. Commutation — reactance voltage and methods of improving commutation. Build-up of EMF in a self-excited DC generator; causes for failure of self-excitation and remedial measures. Internal and external characteristics of DC generators and applications.

**UNIT-III: DC MOTORS (9 Periods)**

Principle of operation of DC motor; Back EMF& its significance; speed and torque equation. Characteristics and applications of shunt, series and compound motors. Speed control of DC shunt and series motor. Electric braking; Starters for DC Motors (2-, 3- and 4-point) and theirdesign.

**UNIT-IV: SINGLE PHASE TRANSFORMERS (10 Periods)**

Introduction — classification of transformers, cooling methods, ideal and practical transformers; operation on no-load and on-load, phasor diagrams; losses, equivalent circuit, efficiency and regulation; Effects of variation of frequency and supply voltage on iron losses. All-day efficiency. Auto transformers — equivalent circuit, comparison with two winding transformers.

**UNIT-V: THREE-PHASE TRANSFORMERS (8 Periods)**

Three-phase transformers — construction and connections — Y/Y, Y/Δ, Δ/Y, Δ/Δ, open-Δ andScottconnections.Threewindingtransformers— tertiarywindings;determinationof ZP, Zs and ZT;OFF-load and ON-load tapchanging.

*Total Periods: 45*

**Topics for Self-study are provided in the Lesson Plan**

**TEXT BOOKS:**

1. JB Gupta, *Theory and performance of Electrical Machines* (DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria& Sons, New Delhi, 15th edition, 2015.
2. R.K. Rajput, *Electrical Machines* in S.I. Units, Laxmi Publications (P) Ltd, 6th edition, New Delhi,2017.

**REFERENCE BOOKS:**

1. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th edition, Delhi,2011.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology(in S. I. Units)*, Vol.2, S. Chand & Company Ltd, Multicolour illustrative edition, New Delhi,2014.

**ADDITIONAL LEARNING RESOURCES:**

1. http://www.nptelvideos.in/2012/11/electrical-machines-i.html 2. https://nptel.ac.in/courses/108/102/108102146/
3. https://freevideolectures.com/course/3085/electrical-machines-i https://www.youtube.com/playlist?list=PL9RcWoqXmzaJpnkjoNleyFNgGk9-znOji

II B.Tech. - I
Semester (16BT30201)
**DCMACHINES**

| Int. Marks | Ext.Marks | Total Marks | L | T | PC |
|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | --3 |

**PREREQUISITES:**CoursesonElectricCircuitsandEngineering Physics.

**COURSE DESCRIPTION:**

Construction,operation,typesandapplicationsofDCm achines;
PerformanceevaluationofvariousDCmachines.

**COURSEOUTCOMES:**Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledge on
- construction and operation of various types ofDC machines
- armaturereactionandcommutation
- characteristics of DCmachines
- paralleloperation of DC generators
- starting,brakingandspeedcontrolofDCmotors
- testing of DCmachines

CO2.analyzetheperformanceofDCmachineforv arious operatingconditions
CO3. design suitable accessories / controllers for desired operation of DC Machines
CO4.solveengineeringproblemspertainingtoDCma chines and provide feasiblesolutions
CO5. apply the conceptual knowledge of DC machines in relevance to societal needs

**DETAILED SYLLABUS:**

**UNIT-I:DCGENERATORS** **(08periods)**

Principle,operationandconstructionaldetailsofgener ator.EMF equation and methods of excitation. Losses - constant, vari-ableandminimizationoflosses.Calculationofefficien cy-con- ditionformaximumefficiency.

**UNIT-II: ARMATURE REACTION AND COMMUTATION (08 periods)** Armaturereaction-crossmagnetizingandde-magnetizingAT/ pole,compensatingwinding.Commutation-reactancevoltage, methodsofimprovingcommutation.

**UNIT-III: CHARACTERISTICS OF DC GENERATORS (10 periods)** OCC of Separately excited DC generator. Build-up of EMF in a self-excited DC generator, critical field resistance and critical speed, causes for failure of self-excitation and remedial mea-sures.Internalandexternalcharacteristicsofshunt,s eriesand compoundgenerators-applications.

Parallel operation of DC generators - conditions for parallel operation, use of equalizer bars and

cross connection of field windings, load sharing.

**UNIT-IV:DCMOTORS (11periods)**

PrincipleofoperationofDCmotor,BackEMF,speedand torque equation.Characteristicsandapplicationsofshunt,seriesand compoundmotors.SpeedcontrolofDCshuntandseriesmotor. Ward-Leonardsystem.Electricbraking.StartersforDCMotors (2-, 3- and4-point).

**UNIT-V:TESTINGOFDCMACHINES (08periods)**

Braketest,Swinburne'stest,Hopkinson'stest,Field's test,Re- tardation test, separation of stray lossestest.

Total Periods: 45

**TEXT BOOKS:**


1. JB Gupta, *Theory and performance of Electrical Machines (DC machines, Poly phase Circuits & AC machines) in SI Units*,S.K.Kataria&Sons,NewDelhi,15th edition, 2015.
2. R.K.Rajput,*ElectricalMachinesinS.I.Units*,LaxmiPublications(P)Ltd,6th edition,NewDelhi,2017.


REFERENCE BOOKS:


1. P.S.Bimbhra,*ElectricalMachinery,*KhannaPublishers,7th edition, Delhi,2011.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical TechnologyinS.I.Units,*Vol.2,S.Chand&CompanyLtd, Multicolourillustrativeedition,NewDelhi,2014.

*II B. Tech. – I Semester*

**(19BT30231) ELECTRICAL MACHINES-1 LAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:**

Basics of Electrical and Electronics Engineering Lab and Electric circuits.

**COURSE DESCRIPTION:**

Speed control and performance characteristics of DC Machines; Determination of losses and performance evaluation of DC machines and transformers.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. evaluate the operating characteristics of DC generators and validate the practical observations with the underlyingconcepts.

CO2. evaluate the operating characteristics of DC motors and validate the practical observations with the underlyingconcepts.

CO3. realize the philosophy of testing procedures of various DC machines and transformers by adhering the code of conduct.

CO4. evaluate the operating characteristics of transformers and validate the practical observations with the underlying concepts.

CO5. work independently / in groups, and communicate effectively in oral and written forms.

**Practical Exercises/List of Experiments:**

Minimum **Ten** experiments are to be conducted.

1. OCC of DC shuntgenerator.
2. Load test on DC shuntgenerator.
3. Brake test on DC Shunt and CompoundMotors.
4. Speed control of DC shuntmotor.
5. Swinburne'stest.
6. Hopkinson'stest.
7. Electric braking of DCmotor.
8. OC and SC tests on 1-Phasetransformer.
9. Separation of core losses in a 1-Phasetransformer.
10. Sumpner'stest.
11. Parallel operation of1-Phasetransformers.
12. Scottconnection.

**TEXT BOOKS:**

1. JB Gupta, *Theory and performance of Electrical Machines*(DC machines, Poly phase Circuits & AC machines) in SI Units, S.K. Kataria& Sons, New Delhi, 15th edition, 2015.
2. R.K. Rajput, *Electrical Machines* in S.I. Units, Laxmi Publications (P) Ltd, 6th edition, New Delhi,2017.

**REFERENCE BOOKS:**

1. P.S. Bimbhra, *Electrical Machinery*, Khanna Publishers, 7th edition, Delhi,2011.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology (in S. I. Units)*, Vol.2, S. Chand & Company Ltd, Multicolour illustrative edition, New Delhi,2014.

**ADDITIONAL LEARNING RESOURCES:**

1. http://vlabs.iitb.ac.in/vlabsdev/vlab_bootcamp/bootcamp/Sadhya-/experimentlist.html
2. http://emcoep.vlabs.ac.in/List%20of%20experiments.html ?domain=Electric-al%20Engineerin

II B.Tech. - I Semester

(16BT30231) **DC MACHINESLAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | PC |
|---|---|---|---|---|---|
| 50 | 50 | 100 | -- | -- | 3 2 |

**PREREQUISITES:**
Courses on Electric Circuits and Electric Circuits Lab

**COURSE DESCRIPTION:**
Construction, operation, types and applications of DC machines; Performance evaluation of various DC machines.

**COURSEOUTCOMES:** On successful completion of the course, students will be able to

CO1. demonstrate knowledgeon
- constructionandworkingofvarioustypes ofDCma- chines.
- starting,brakingandspeedcontrolofDCmotors.
- testing of DCmachines.
- paralleloperationofDCgenerators.
- characteristics of DCmachines.

CO2. analyzetheperformanceofDCmachinesforv ariousop eratingconditions.

CO3. designthecircuitwithsuitableaccessories/co ntrollers fordesiredoperatingconditionsofDCmachine s.

CO4. interpretandsynthesizethedataobtainedfr omexperi mentation on DC machines and provide valid conclusions.

CO5. select and apply appropriatetechnique for testing and controlofDCmachinesusedinindustry.

CO6. applytheconceptualknowledgeofDCmachi nesinrelevance to industry and society.

CO7. committoethicalprinciplesandstandards whileexercisingthepracticalinvestigation sonDCmachines.

CO8. workindividuallyorinagroupwhileexercising practical investigationsinthefieldofDCmachines.

CO9. communicateeffectivelyinverbalandwritt enformin relevancetoDCmachines.

**DETAILED SYLLABUS:**

**PART-A:**

1. ConstructionofDCmachineandDCmotorstarters.

2. Armaturewindings-lapandwave,simplexandmultiplex,singlelayerandmulti-layer,equalizerringsanddummy coils.

**PART-B: Any EIGHT experiments are to be conducted from the following**

1. MagnetizationcharacteristicofDCshuntgenerator.
2. Load test on DC shuntgenerator.
3. Load test on DC seriesgenerator.
4. LoadtestonDCcompoundgenerator(cumulativeand differentialconnections).
5. ParalleloperationofDCgenerator
6. Speed control of DC shuntmotor.
7. BraketestonDCcompoundmotor.
8. BraketestonDCshuntmotor.
9. BraketestonDCseriesmotor.
10. Swinburne'stest.
11. Hopkinson'stest.
12. Field'stest.
13. SeparationoflossesinDCshuntmachine.
14. ElectricbrakingofDCmotor

*II B. Tech. – I Semester*

**(19BT30232) SIGNALS AND NETWORKS LAB**

**(EEE)**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:**

Transformation techniques and linear algebra and Electric circuits.

***COURSE DESCRIPTION:***

Practical investigations through simulation on signals and systems; Spectral analysis of signals, and analysis of transients and two-port networks.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. evaluate, analyze the characteristics/responses of various signals and systems, and interpret the practical observations forvalidation.

CO2. analyze spectral characteristics of signals/response in frequency domain using Fourier, Laplace andz-Transforms.

CO3. analyze transient behavior of DC & AC circuits using

mathematical methods and design timer circuits for desiredspecifications.

CO4. analyze network parameters of an isolated and interconnected two-port networks and design impedance and gain matchingnetworks.

CO5. work independently / in groups, and communicate effectively in oral and written forms.

***Practical Exercises/List of Experiments:***

Minimum Five experiments are to be conducted from each part.

***PART-A:***

1. Generation of continuous and discrete timesignals.
2. Basic operations on continuous and discrete time signals — Time scaling and mplitudescaling.
3. Systems and their properties — Linearity, causality andstability.
4. Response of LTI systems for differentexcitations.
5. Analysis of signals — Amplitude and Phasespectrum.
6. Convolution in frequency domain — Laplace andz-transforms.

***PART-B:***

7. TransientresponseofRLcircuitanddesignoftimercircuit.
8. TransientresponseofRCcircuitanddesignoftimercircuit.
9. Transient response of RLC circuit andapplications.
10. Determination of two-port network parameters in an isolated networks — Z, Y, ABCD andh-Parameters.
11. Determination of two-port network parameters in an interconnected networks — Series-Series, Parallel-Parallel and cascadedinterconnections.
12. Design of impedance matching two-portnetwork.

***TEXT BOOKS:***

1. Lathi&BhagwandasPannalal, *Principles of Linear Systems and Signals,* Oxford University Press, 2nd edition,2009.

2. CharlesK.Alexander&MatthewN.O.Sadiku,*FundamentalsofElectricCircuits,* McGraw-Hill education Private Limited, New Delhi, 5th edition, 2013.

***REFERENCE BOOKS***

1. Matthew N Sadiku, and Warsame Hassan Ali, *Signals and Systems: A Primer with MATLAB,* CRC Press,2016.
2. Alex Palamides Anastasia Veloni, *Signals and Systems Laboratorywith MATLAB*, CRC Press Taylor & Francis Group,2011.

***ADDITIONAL LEARNING RESOURCES:***

1. http://ssl-iitg.vlabs.ac.in/
2. https://nptel.ac.in/courses/117/101/117101055/
3. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video- lectures/

II B.Tech. - I Semester

16BT30232:**SIGNALSANDNET WORKSLAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | -- | -- | 3 | 2 |

***PREREQUISITES:***

CoursesonMulti-variablecalculus&Differentialequations,Trans-formation Techniques & Partial Differential Equations, Electric circuits and Electric CircuitsLab.

***COURSE DESCRIPTION:***

Experimentation on Signals and systems; Transient analysis; Twoport network parameters and passive filters.

**COURSEOUTCOMES:**Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrateknowledgeonsignals,transients,twoport networks & filters and their experimental implementation.

CO2. analyzeandrelatetheexperimentalobservations&mea surementsforvalidation.

CO3. designasuitableexperimental/simulationprocedurefor practical investigations on signals, systems and net works.

CO4. demonstrateskillsinevaluatingvariousparametersand interprettheobservationstoprovidefeasiblesolutions.

CO5. selectappropriatetechniqueforexperimentalinvestigations, analysis and interpretation of signals and net works.

CO6. applytheconceptualknowledgeofsignals,transients, filters and twoport network models in relevance to in dustry andsociety.

CO7.commit to ethical principles and standards while exercising the practical investigations on signals and net works.

CO8. workindividuallyorinagroupinthefieldofsignalsand networks.

CO9. communicateeffectivelyinverbalandwrittenformin signalsandnetworksdomain.

***LIST OF EXPERIMENTS:***

Conduct any **TEN** experiments using appropriate Software Tools / Hardware

1. Generationofcontinuoustimesignals.
2. Basic operationson the signals.
3. Systems and theirproperties.
4. Convolution ofsignals.
5. Transformationofsignalsintotimeandfrequencydo mains.
6. TransientresponseofRLcircuitandapplications.
7. Transient response of RC circuitandapplications.
8. TransientresponseofRLCcircuitandapplications.
9. Determination of Open circuit and Short circuit parameterisinisolatedandinterconnectednetworks.
10. DeterminationofABCDandHybridparametersinisolated and interconnectednetworks.
11. Design, analysis and application of Low pass and High passfilters.
12. Design, analysis and application of Band Pass and Band stopfilters.

**II B. Tech. – II Semester**

**(19BT40202) ELECTRICAL MACHINES-2**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 1 | - | 4 |

**PRE-REQUISITES:**

Electrical Machines-1 and Electrical Machines-1 Lab.

**COURSE DESCRIPTION:**

Construction, types, operation and applications of induction machines and synchronous machines; parallel operation of synchronous generators; Performance evaluation of induction machines and synchronous machines.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. analyze the performance of induction machine to evaluate the operating parameters and to asses feasible control strategies.

CO2. analyze the performance of synchronous generator to evaluate the operating parameters and to assess measures for sustainability.

CO3. analyze the synchronized operation of alternators and the effect of influencing factors on synchronization, and to determine feasible operating state for sustainability.

CO4. analyze the performance of synchronous motor to evaluate the operating parameters, and to determine sustainable and feasible operating states for variousloadings.

## DETAILED SYLLABUS:

**UNIT-I: THREE PHASEINDUCTIONMOTORS** **(9Periods)**

Production of rotating magnetic field in 3-phase Induction motor, slip, rotor EMF and rotor frequency, rotor reactance, rotor current and power factor at standstill and running conditions; ratio of full-load torque and maximum torque, ratio of starting torque and maximumtorque;lossesin3-phaseinductionmotor,relationbetweenrotorpowerinput, rotor copper loss and mechanical power developed. Induction motor as a generalized transformer. Double-cage and deep barrotors.

**UNIT-II: STARTING AND SPEED CONTROL METHODS** **(9 Periods)**

Methods of starting — starting current and torque calculations for direct online, primary resistors, auto transformer and star-delta starters; Crawling and Cogging; Speedcontrol— change of frequency, voltage and stator poles, rotor rheostat control, cascade connection and injection of EMF into rotor circuit. Induction generator — principle of operation and its applications.

**UNIT-III: SYNCHRONOUS GENERATORS** **(10 Periods)**

Armaturewindings— integralslotandfractionalslot,distributedandconcentrated,short pitch and full pitch, winding factors; EMF equation, harmonics in generated EMF and suppression of harmonics. Armature reaction and its effect for various operating power factors.— phasor diagrams; Power flow equations in synchronous generator. Salient pole alternators —two-reaction theory, phasor diagrams and voltageregulation.

**UNIT-IV: PARALLEL OPERATION OF SYNCHRONOUS GENERATORS (10 Periods)**

Conditions for parallel operation; methods of synchronization; Synchronizing current, power and torque, rigidity factor. Effect of change of excitation and mechanical power input on parallel operation of two alternators, load sharing between two alternators; Synchronous machines on infinite bus bars. Short Circuit Ratio (SCR) and its significance. Time period of rotoroscillations.

**UNIT-V: THREE PHASE SYNCHRONOUS MOTORS (7 Periods)**

Principle of operation; starting methods —auxiliary motor, damper winding, synchronous-inductionmotor.Phasordiagrams;Variationofarmaturecurrentandpower factor with excitation; synchronous condenser. Power flow equations in synchronous motor. Circle diagram — excitation and power circles. Hunting and itssuppression.

**Total Periods: 45**

**Topics for Self-study are provided in the Lesson Plan**

**TEXT BOOKS:**

1. P.S. Bimbhra, *Electrical Machinery*, 7th edition, Khanna Publishers, New Delhi,2011.

2. JB Gupta, *Theory and performance of Electrical Machines (DC machines, Poly phase circuits&ACmachines)inSIUnits*,15th edition,S.K.Kataria&Sons,NewDelhi,2015.

**REFERENCE BOOKS:**

1. A.E. Fitzgerald, C.Kingsley and S.Umans, *Electric Machinery*, 6th edition, McGraw-Hill, New Delhi,2008.

2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology in S. I. Units*, Vol.2, S.Chand Company Ltd, Multicolour edition, New Delhi,2014.

II B.Tech. - II Semester

## (16BT40203) TRANSFORMERS AND INDUCTION MACHINES

| Int. Marks | Ext. Marks | Total Marks | L | T | PC |
|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | --3 |

**PREREQUISITES:** Course on DC Machines, Electromagnetic Fields.

COURSE DESCRIPTION:
Constructionaldetails,principleofoperation,equivalentcircuit, testing,performanceandapplicationsoftransformers andthree phase inductionmotors.

**COURSEOUTCOMES:**Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- construction, operation of various types oftransform ers and inductionmachines.
- characteristicsoftransformersandinductionmachines.
- paralleloperation oftransformers.
- starting,brakingandspeedcontrolofinductionma chines.
- testingoftransformersandinductionmachines.

CO2. analyzetheoperationandperformanceoftransformers andinductionmachinesforvariousoperatingconditions.

CO3. designsuitableaccessories/controllersformachinesto meet the desiredspecifications.

CO4. solve engineering problems pertaining fortransformers andinductionmachinestoprovideviablesolutions.

CO5. selectappropriatetechniquesandtoolsfordesiredop eration of transformers and induction machines in domestic,agricultureandindustrialapplications.

CO6. apply the conceptual knowledge of Transformers and InductionMachinesinrelevancetoindustry andsociety.

DETAILED SYLLABUS:

**UNIT-I: SINGLEPHASETRANSFORMERS (10periods)**

Single phase transformers - working principle, constructional details, types, ideal transformer, EMF equation, operation on no-load and on-load,

phasor diagrams, losses, equivalent cir- cuit, OC and SC tests, separation of losses test, efficiencyand regulation.Effectsofvariationoffrequencyandsuppl yvoltage on ironlosses.

**UNIT-II: TRANSFORMER TESTING AND AUTOTRANSFORMER (08periods)**

Polarity test, Sumpner's test, all day efficiency.Parallel opera

tionwithequalandunequalvoltageratios.Autotransf ormers- equivalentcircuit,comparisonwithtwowindingtrans formers.

**UNIT-III: THREE PHASE TRANSFORMERS (08 periods)**

Introduction to three-phase transformers. Three-phasetrans-

former connections - Y/Y, Y/$\Delta$, $\Delta$/Y and $\Delta/\Delta$, open $\Delta$and Scott

connections. Three winding transformers -tertiary windings, determinationof$Z_p$,$Z_s$and$Z_t$.OFF-loadandON-loadtapchang- ing.

**UNIT-IV: THREE PHASE INDUCTION MOTORS (09 periods)**

Three phase induction motors -construction details of cage and wound rotor machines, production of rotating magnetic field,principleofoperation,rotorEMFandrotorfreque ncy,ro- tor reactance, rotor current and power factor at standstill and during operation, torque equation - expressions formaximum torque and starting torque, torque-slip characteristics, rotor power input, rotor copper loss and mechanical power devel- opedandtheirinterrelation.Double-cageanddeepbarrotors. Equivalentcircuitandphasordiagram.

**UNIT-V: CIRCLE DIAGRAM, STARTING AND SPEED CONTROL METHODS (10 periods)**

No-load and blocked rotor tests, stator resistance test, circle diagram,predeterminationofperformance.Methods ofstarting - starting current and torque calculations. Crawling and cog- ging. Speed control - change of frequency, change of poles, cascadeconnection,injectionofemfintorotorcircuit( qualita- tive treatment only). Induction generator - principle ofopera- tion.

**TEXT BOOKS**


1 JBGupta,Theoryandperformanceof*ElectricalMachines (DC machines, Poly phase circuits & AC machines) in SI Units*,S.K.Kataria&Sons,NewDelhi,15th edition,2015.

2 P.S.Bimbhra,*ElectricalMachinery*,KhannaPublishers,New Delhi, 7th edition,2011.

**REFERENCE BOOKS:**


1. A.E.Fitzgerald,C.KingsleyandS.Umans,*ElectricMachinery*, McGraw-Hill,NewDelhi,6th edition,2008.
2. B.L. Theraja and A.K. Theraja, A Text Book of *Electrical Technology in S. I. Units*, Vol.2, S.Chand Company Ltd, Multicolouredition,NewDelhi,2014.

**II B. Tech. – II Semester**

**(19BT40204) TRANSMISSION AND DISTRIBUTION**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES:**

Electromagnetic Fields, and Signals and Networks.

## COURSE DESCRIPTION:

Parameters of overhead transmission lines and underground cables; Performance of transmission lines, travelling wave phenomenon; Insulators; Sag and corona; Distribution systems classification, analysis and planning.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. analyze the overhead lines and underground cables to evaluate various parameters and their characteristics for differentconfigurations.

CO2. analyze the performance of transmission lines and investigate the behaviour of travelling waves for different configurations of transmissionlines.

CO3. analyze the mechanical and electrical aspects of overhead transmission linesand realize measures forsustainability.

CO4. analyze various distribution systems, to determine their performance characteristics under various scenarios.

CO5. realize various aspects of substation, and analyze the primary and secondary feederssystemsofsubstationtoconfigurethefeederlayoutinaservicearea.

## DETAILED SYLLABUS:

**UNIT-I: OVERHEAD TRANSMISSION LINE AND UNDERGROUND CABLES** **(11Periods)**

**Overhead Transmission Lines**: Overhead line and underground cables and its types, Parameters- resistance, inductance and capacitance calculations in single and three phase transmission lines, single and double circuits, symmetrical and unsymmetrical spacing, concepts of GMR and GMD-Effect of earth oncapacitance.

**Underground Cables**: Construction, types of insulating materials, classification of cables, laying of cables, insulation resistance, capacitance of single and 3-core belted cables, grading of cables - capacitance and inter sheath grading.

**UNIT-II: ANALYSIS OF TRANSMISSION LINES** **(11 Periods)**

**Modelling and Analysis of Transmission lines**: Classification - short line, medium line and long line; equivalent circuits –end condenser, Nominal-T, Nominal- models, rigorous method; ABCD constants, voltage regulation and efficiency of transmission lines.

**Travelling waves on transmission lines**: Travelling waves – open end line, short circuited line, Line terminated through a resistor, line connected to a cable, Line connected to a T-junction.

**UNIT-III: MECHANICAL ASPECTS OF OVER HEAD LINE AND CORONA** **(08 Periods)**

**Insulators—** Line supports, overhead line insulators, types of insulators, string efficiency and methods forimprovement.

**Sag in overhead line**: Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on sag, stringing chart.

**Corona**:Coronaphenomenon-factorsaffectingcorona,criticalvoltagesandpowerloss, advantages anddisadvantages.

**UNIT-IV: DISTRIBUTION SYSTEMS** **(07 Periods)**

Classification and Characteristics—residential, commercial, agricultural and industrial loads. Voltage drop calculations in DC distributors– radial DC distributor fed at one end, at both the ends (equal/unequal voltages)and ring main distributor. Voltage drop calculations in AC distributors– power factors referred to receiving end voltage and respective load voltages.

**UNIT-V: SUBSTATIONS** **(08 Periods)**

Classification of substations — Indoor and outdoor, gas and air insulated substations; Substation layout, different bus bar schemes, location of substations andbenefits through optimal location — rating of distribution substations, service area with 'n' primary feeders; Considerations of distribution feeder voltage levels: Radial and loop types of primary feeders and secondary feeders – Feeder loading – Basic design practice of the secondary distribution system.

**Total Periods: 45**

**Topics for Self-study are provided in the Lesson Plan**

**TEXT BOOKS:**


1. Wadhwa, C. L. *Electrical power systems*. 7th edition, New Age International Private limited,2017.
2. TuranGonen, *Electric Power Distribution System Engineering,* 3rd edition CRC Press, Taylors and Francis Group,2014.


**REFERENCE BOOKS:**


1. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt Ltd, New Delhi,2002.
2. U.A.Bakshi and M.V.Bakshi, *Transmission and Distribution of Electrical Power*, Fourth revised edition, Technical Publications,2009.
3. J.B.Gupta, *A Course in Electrical Power*, 11th edition, S.K.Kataria& sons, New Delhi 2013.
4. V.K.Mehta, Rohit Mehta, *Principles of Power System,* revised edition, S.Chand& Company Ltd,2013.


**ADDITIONAL LEARNING RESOURCES:**

1. TravellingWave:https://www.eeeguide.com/travelling-waves-on-transmission-lines/
2. Travelling Waves Lecture:https://nptel.ac.in/courses/108/102/108102119/
3. Power System:https://nptel.ac.in/courses/108/105/108105104/
4. https://edisontechcenter.org/Transmission.html
5. http://www.minnelectrans.com/transmission-system.html
6. Distribution System:https://nptel.ac.in/courses/108/102/108102047/

III B.Tech.-I Semester

## (16BT50204)**TRANSMISSIONANDDISTRIBUTION**

| Int. Marks | Ext. Marks | Total Marks | L | T | PC |
|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | --3 |

**PREREQUISITES:** CoursesonGenerationofElectric Power,Electromagnetic FieldsandSignals,Systems&Networks.

COURSE DESCRIPTION:
Parameters of overhead transmission lines and underground cables;Performanceoftransmissionlines,travellingwavephenomenon; Types of insulators; Sag and corona; Distribution systemsclassification,analysisanditsplanning.

**COURSEOUTCOMES:**Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- classificationoftransmissionanddistributionsystems
- parametersandconfigurationsoftransmissionanddistributionsystems
- transients, corona andsag
- insulationsystemforcablesandtransmissionlines

CO2. analyze
- the electrical and mechanical aspects of cables and transmissionlines
- variousdistributionfeederconfigurations
- voltagedropandpowerlossindistributionsystem

CO3. design
- parametersfortransmissionlinesandunderground cables.
- substationfeeders.

CO4. evaluatetheparameters,performance&mechanicalaspectsoftransmissionlines,undergroundcablesanddistributionsystemstoprovidefeasiblesolutions.

CO5. selectappropriate model for transmission and distributionsystemswhileexercisingmodelingandplanningof powersystem.

CO6. applytheconceptualknowledgeoftransmissionanddistributionsystemsinrelevancetoindustryandsociety.

CO7. followprofessionalnormsforvoltageregulationintransmissionanddistributionsystems.

DETAILED SYLLABUS:

**UNIT-I: OVERHEAD TRANSMISSION LINE AND UNDER GROUND CABLES (10 periods)**

**TRANSMISSIONLINES:**Overheadline&undergroundcables and their types, Parameters - resistance, inductance and ca- pacitance calculations in single and three phase transmission lines,singleanddoublecircuits,symmetricalandunsymmetrical spacing, concepts of GMR and GMD, effect of earth oncapaci- tance.

Underground cables:Construction, types of insulating materials, classification of cables, laying of cables, insulation resistance, capacitance of single and 3-core belted cables.Grading of cables - capacitance and inter sheath grading.

**UNIT-II: ANALYSIS OF TRANSMISSION LINES (10 periods)**

Transmission lines:Classification - short line, medium lineand long line.Equivalent circuits -end condenser, Nominal-T, Nominal-pie models. ABCD constants, voltage regulation and efficiencyof transmissionlines.
Travellingwavesontransmissionlines:Travellingwaves-open endline,shortcircuitedline,lineterminatedthrougharesistor, line connected to a cable, T-junction.Beweley's Lattice dia- gram.

**UNIT-III: MECHANICAL ASPECTS OF OVER HEAD LINE AND CORONA (09periods)**

Overheadtransmissionline:Linesupports,overheadlineinsulators, types of insulators, string efficiency and methods forimprovement.
Sag in overhead line:Sag and tension calculations with equal and unequal heights of towers, effect of wind and ice on sag, stringing chart.
Corona: Corona phenomenon - factors affecting corona, critical voltages and power loss, advantages and disadvantages.

**UNIT-IV: DISTRIBUTIONSYSTEMS (08 periods)**

ClassificationandCharacteristics-residential,commercial,agriculturaland industrialloads.
VoltagedropcalculationsinDCdistributors-radialDCdistributorfedatoneend,atboththeends(equal/unequalvoltages)andring maindistributor.
Voltage drop calculations in AC distributors - power factors referredtoreceivingendvoltageandrespectiveloadvoltages.

**UNIT-V: SUBSTATIONS AND DISTRIBUTION SYSTEM PLANNING (08 periods)**

Classification of substations:Indoor and outdoor, gas and air insulated substations. Substation layout, different bus bar schemes, location of substations-rating of distributionsubstations,serviceareawith'n'primaryfeeders.
Distribution System Planning:Factorsaffectingsystem planning, substation expansion, distribution system planning models, present distribution system planning techniques.

**Total Periods: 45**

**TEXT BOOKS:**


1. C.L.Wadhwa, *Electrical power systems*, New Age International Publishers, 6th edition,2010.
2. TuranGonen, *Electric Power Distribution System Engineering*,McGrawHillBookCompany,2nd edition,2012.


**REFERENCE BOOKS:**


1. U.A.BakshiandM.V.Bakshi,*TransmissionandDistributionof ElectricalPower*,1st edition,TechnicalPublications,2009.
2. B.Gupta, *A Course in Electrical Power,* S.K.Kataria& sons, NewDelhi,11th edition,2009.
3. V.Kamaraju, *Electrical Power Distribution Systems*, McGraw HillEducationPrivateLimited,1st edition,2009.
4. V.K.MehtaandRohithMehta,*PrinciplesofPowerSystems*,S Chand&CompanyLtd,NewDelhi,4thMulticolourillustrative edition,2006.

**II B. Tech. – II Semester**

**(19BT40231) DIGITAL ELECTRONICS LAB**

**(EEE)**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:**

Electronic devices and circuits.

**COURSE DESCRIPTION:**

Practical investigations through simulation on logic gates; minimization of circuits; design of various combinational and sequential logiccircuits.

**COURSEOUTCOMES:**Aftersuccessfulcompletionofthecourse,studentswillbeable to:

CO1. perform various arithmetic operations on number systems and analyze simplification methods in logical circuits, to perform desired logical operations optimally using logical gates.

CO2. design combinational logical circuits for performing various arithmetic operations and data encoding and decoding for engineering applications.

CO3. analyze various sequential circuits for realizing counters and registers using flip- flops.

CO4. work independently / in groups, and communicate effectively in oral and written forms.

**Practical Exercises/List of Experiments:**

**Part-A: Analytical Exercises:**

1. Number systems and theirconversions.
2. Arithmetic operations on weighted non-weightednumbers.

**Part-B: Any EIGHT experiments are to be conducted from the following**

1. Verification of logicgates.
2. Minimization of logic circuits usingK-Map.
3. Design of half adder &subtractor and full adder &subtractor.

4. Design of 4 bitcomparator.
5. Design of 3 to 8 decoder & 8 to 3 encoder for an engineeringapplication.
6. Design of 8 to 1multiplexer.
7. Design of 4 bit
    a. binary adderand
    b. binaryadder-subtractor
8. Design of 4 bit binary in crementer using 4 halfadders.
9. Design of 4-bit combinational circuitshifter.
10. Design of BCD to seven segmentdecoder.
11. Design of 1 stage of logic circuit using logical gates and 4x1multiplexer.
12. Design SR, JK, T and D Flip flops using logicgates.
13. Design a ring counter using flipflops.

**TEXT BOOKS:**

1. M. Morris Mano, *Digital Design*, Pearson education, 5th edition, 2013.

**REFERENCE BOOKS**

1. Anand Kumar, *Switching Theory and Logic Design*, PHI,2008
2. ZviKohavi and NirahK.Jha, *Switching theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd edition,1978

**ADDITIONAL LEARNING RESOURCES:**

1. http://cse15-iiith.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/labs/index.php

*II B.Tech. – II Semester*

**(19BT40232) ELECTRICAL ENGINEERING WORKSHOP**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 2 |

**PRE-REQUISITES:**

Electric Circuits Lab and Electrical Machines-1 Lab.

**COURSE DESCRIPTION:** Exercises on assessing of electrical parameters and functionality of electrical apparatus; Design and estimation of electrical systems, and protection system for electrical devices and systems; Troubleshooting of electrical appliances and Calibration of measuring instruments.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. evaluate various electrical quantities using modern utilities, assess the functionality of various devices and analyze the practical observations for calibration.

CO2. design operating equipment for the various electrical appliances for sustainable operation, and estimate typical house wiring system following the code of conduct and realize the technological developments in design of operating equipment.

CO3. analyze various electrical appliances for troubleshooting and maintenance, and protection schemes for safety of personals and apparatus, and realize the technological developments in protection.

CO4. work independently / in groups, and communicate effectively in oral and written forms.

**List of Exercises/List of Experiments:**

Minimum **Ten** experiments are to be conducted.

1. Measurement of electrical quantities usingMFM.
2. Operation and testing of Fuse, MCB andRelays.
3. Calibration of measuringinstruments.
4. Practice bridges for measurement of circuit elementparameters.
5. Design of starter for DCMotors.
6. Practicing and testing of DOL starter for InductionMotors.
7. Design of Timers for operation of electricalappliances.
8. Design and estimation of wiring for a typicalhouse.
9. Troubleshootingofelectricalappliances—

   Fan,Mixer/grinder,Waterheater/Iron box.
10. Practicing plate and pipe earthingsystem.
11. Protection scheme for a 3-Phase Induction Motor. (Single Phasing, OL, DryRun)
12. Installation and maintenance ofUPS.

**REFERENCE BOOKS/LABORATORY MANUALS:**

1. http://www.srisaiuniversity.org/downloads/files/n59b79d6117211.pdf
2. https://www.gtu.ac.in/syllabus/NEW_Diploma/sem-1/Pdf%20Content%20detailing/3312401Electrical%20&%20Electronic%20Workshop.pdf

**ADDITIONAL LEARNING RESOURCES:**

1. https://www.youtube.com/watch?v=ax-KUL17YJ4
2. https://www.youtube.com/watch?v=TJpQ3fZIt20
3. https://www.youtube.com/watch?v=6RJnsa83xTA
4. https://www.youtube.com/watch?v=w2M4tS2OMsU
   https://www.youtube.com/watch?v=DzVJiSQNbew

**II B. Tech. – II Semester**

**(19BT40233) ELECTRICAL MACHINES-2 LAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 2 |

**PRE-REQUISITES:**

Electrical Machines-1 and Electrical Machines-1Lab

**COURSE DESCRIPTION:**

Practical investigations on asynchronous and synchronous machines; Performance indices analysis, determination of equivalent circuit parameters and speed control methods of induction motor.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. analyze the performance of induction machines to evaluate operating parameters and interpret the practical observations forvalidation.

CO2. analyze the performance of synchronous machines to evaluate operating parameters and interpret the practical observations forvalidation.

CO3. analyze the performance of universal motor for various loadingconditions.

CO4. realize the philosophy of testing procedure of synchronous and asynchronous machines following the code ofconduct.

CO5. work independently / in groups, and communicate effectively in oral and written forms

***List of Exercises/List of Experiments:***

Minimum Ten experiments are to be conducted.

1. Brake test on three phase inductionmotor.
2. Separation of no-load losses of three phase inductionmotor
3. Speed control of inductionmotor

4. No load and blocked rotor test on three phase inductionmotor.
5. Regulation of a three phase alternator by E.M.F and M.M.F.methods.
6. Regulation of three phase alternator by Z.P.F. and A.S.Amethods.
7. Efficiency of a three phasealternator.
8. Slip test on a salient pole synchronousmachine.
9. V and inverted V curves of a three phase synchronousmotor.
10. Equivalent circuit of single phase inductionmotor.
11. Brake test on universalmotor.
12. Parallel operation ofalternators.

***TEXT BOOKS:***


1. P.S. Bimbhra, *Electrical Machinery*, 7th edition, Khanna Publishers, New Delhi,2011.
2. JB Gupta, *Theory and performance of Electrical Machines (DC machines, Poly phase circuits&ACmachines)inSIUnits*,15thedition,S.K.Kataria&Sons,NewDelhi,2015.


***REFERENCE BOOKS:***


1. A.E. Fitzgerald, C.Kingsley and S.Umans, *Electric Machinery*, 6th edition, McGraw-Hill, New Delhi,2008.
2. B.L. Theraja and A.K. Theraja, *A Text Book of Electrical Technology in S. I. Units*, Vol.2, S.Chand Company Ltd, Multicolour edition, New Delhi,2014.

II B.Tech. - II Semester

## (16BT40232)**TRANSFORMERSAND INDUCTION MACHINES LAB**

| Int. Marks | Ext. Marks | Total Marks | L | T | PC |
|---|---|---|---|---|---|
| 50 | 50 | 100 | -- | -- | 3 2 |

**PREREQUISITES:** Course on DC Machines Lab

**COURSE DESCRIPTION:**
Construction,types,operationandapplicationsoftra nsformers andinductionmachines;Performanceevaluationoftr ansform- ersandinductionmachines.

**COURSEOUTCOMES:**Onsuccessfulcompletionofthecourse, students will be ableto

CO1. demonstrate knowledgeon
- construction,operationofvarioustypesoftr ansform ers and inductionmachines.
- startingandspeedcontrolofinductionmachines.
- testingoftransformersandinductionmachines.
- paralleloperation oftransformers.
- characteristicsoftransformersandinductionmachines.

CO2.analyze the performance of transformers and induction motors for various operating conditions.

CO3. design the circuit with suitable accessories /controllers fordesiredoperationofTransformersandIndu ctionmo tors.

CO4. interpretandsynthesizethedataobtainedfro mexperimentationontransformers&induction machinesandpro vide validconclusions.

CO5. select and apply appropriatetechnique for testing and control of transformers & induction machines used in domesticandindustrialapplications.

CO6. apply the conceptual knowledge of Transformers and Inductionmotorsinrelevancetoindustryand society.

CO7. commit to ethical principles and standards while exercisingthepracticalinvestigationsonTra nsformersand Inductionmotors.

CO8.workindividually or in a group while exercising practical investigationsinthefieldofTransformersandI nduction motors.

CO9.communicate effectively in verbal and written form in relevance to Transformers and Induction motors.

**DETAILED SYLLABUS:**
**PART-A:**

1. Construction oftransformers

2. Constructionofthreephaseinductionmotors.

**PART-B:**Any**EIGHT**experimentsaretobeconductedfromthe following

1. OCandSCtestsonsinglephasetransformer.
2. Separationofcorelossesofasinglephasetransformer.
3. Loadtestonsinglephasetransformer.
4. Sumpner'stestonapairofsinglephasetransformers.
5. Conversionofsinglephasetransformerintoautotransformer.
6. Paralleloperationofsinglephasetransformers.
7. Scott connection oftransformers.
8. Heat run test on a bank of single phase delta connected transformers.
9. Braketestonthreephaseinductionmotor.
10. Separationofno-loadlossesofthreephaseinductionmotor.
11. No-loadandblockedrotortestsonthreephaseinduction motor.
12. Speedcontrolofinductionmotor.

*II B. Tech. – II Semester*

**(19BT315AC) DESIGN THINKING**

(Audit Course) (Common to EEE, ECE & EIE)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| - | - | - | 2 | - | - | - |

*PRE-REQUISITES: -*

***COURSE DESCRIPTION:***

Design thinking process, Design thinking phases, empathy tools; Idea generation, visualizingandempathizing;Fidelityforprototypes,prototyping;prototypingforphysical products.

**COURSE OUTCOMES:** After successful completion of this course, the students will be able to:

CO1. Analyze design thinking concepts and principles to perform human centered design process for creative problemsolving.

CO2. Create empathy maps to visualize user attitudes and behavior for gaininginsights of customers.

CO3. Develop innovative products or services for a customer base using ideation techniques.

CO4. Build prototypes for complex problems using gathered userrequirements.

CO5. Apply design thinking tools techniques to produce good design and relevant products or services for a

specific targetmarket.

CO6. Improve prototype by testing it with a specific set of users for making it sustainable by followingethics.

**DETAILED SYLLABUS:**

**UNIT-I: INTRODUCTION TODESIGNTHINKING (6Periods)**

DesignThinkingProcess:Typesofthethinkingprocess,Commonmethodstochangethe human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, Understanding design thinking and its process model, Design thinkingtools.

**UNIT-II: EMPATHIZE (6 Periods)**

Design thinking phases, How to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools : Customer Journey Map, Personas.

**UNIT-III: IDEATION (6 Periods)**

Challenges in idea generation, need for systematic method to connect to user, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method**,** Ideation Tools: How Might We? (HMW), Story board, Brainstorming.

**UNIT-IV: PROTOTYPING (6 Periods)**

What is a prototype? - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping-Minimum Viable prototype

**UNIT-V:TESTING PROTOTYPES (6 Periods)**

Prototyping for digital products: What's unique for digital, Preparation; Prototyping for physical products: What's unique for physical products, Preparation; Testing prototypes with users.

*Total Periods: 30*

**Topics for Self-Study are provided in Lesson Plan**

**TEXTBOOK:**

1. S.Salivahanan,S.Suresh Kumar, D.Praveen Sam, "*Introduction to Design Thinking*",Tata McGraw Hill, FirstEdition,2019.
2. Kathryn McElroy, "*Prototyping for Designers: Developing the best Digital andPhysical Products*", O'Reilly,2017.

**REFERENCE BOOKS**

1. Michael G. Luchs, Scott Swan , Abbie Griffin, "*Design Thinking – New Product Essentials from PDMA*", Wiley,2015.
2. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", John Wiley & Sons,2012.

**ADDITIONAL LEARNING RESOURCES:**

1. https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process
2. https://www.ibm.com/design/thinking/page/toolkit
3. https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we
4. https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking

5. https://nptel.ac.in/courses/109/104/109104109/
6. https://nptel.ac.in/courses/110106124/

**I B. Tech. - I Semester (ECE, EEE & EIE) /**
**I B. Tech. - II Semester (CSE,CSSE,IT,CE & ME)**

## (19BT1AC01) SPOKEN ENGLISH

(Audit Course)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| - | - | - | 2 | - | - | - |

**PRE-REQUISITES: -**

**COURSE OBJECTIVES:**

- To impart the knowledge of day to day conversational expressions.
- To enhance contextual vocabulary and technical jargon for effective usage of language.
- To improve functional grammar for speaking and writing without errors.
- To acquaint with appropriate conversational and narrating techniques for effective communication.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Analyze the techniques of listening, speaking, reading, writing and apply through functional English to communicate effectively with the engineering community and society.

**DETAILED SYLLABUS:**

**UNIT I - FUNCTIONAL ENGLISH: (6 periods)**

Introduction - Functional Spoken English; Just a Minute; **Listening – Speaking:** Do's and Don'ts; **Expressing:** Ability/ Admiration/ Agreement/ Anger/ Annoyance/ Appreciation/ Pleasure/ Sarcasm/ Satisfaction/ Surprise/ Approval/ Capability/ Certainty/ Condolences/ Doubt/ Fear/ Gratitude/ Possibility/ Worry; **Asking for:** Advice/ Clarification/ Direction/ Information/ Permission/ Predictions/ a recommendation

**UNIT II - VOCABULARY BUILDING: (6 periods)**

Vocabulary for day-to-day conversations; Introduction: Vegetables/ Groceries/ Fruits/ Weather; Parts of a Human body/ Dresses/ Furniture/ Relations; Birds/ Cries of Animals; Food/ Hospitality/ Houses/ Rooms/ Tools; Airport/ News Paper/ Books/ Gems; Corporate

Vocabulary/ Jobs/ Occupations/ Diseases; British/ American spelling; Slang Words and Technical Jargon

**UNIT III - FUNCTIONAL GRAMMAR - I: (6 periods)**

English Grammar and the Indian Student; Introduction: Parts of Speech, Verb forms; Tenses; Voice; Speech

**UNIT IV - FUNCTIONAL GRAMMAR - II: (6 periods)**

Universal Auxiliaries; Sentence making for an effective communication; Sentence Structure -WH- Questions - How to frame Questions and give answers; Question Tags; Subject and verb agreement; Spotting Errors

**UNIT V – COMMUNICATION SKILLS: (6 periods)**

Polite, Courteous and diplomatic terms; Useful daily expressions; Courtesy, Good manners and Etiquette; Conversation Techniques; Narrating/ Reading/ Listening to stories; Telling Stories

**Total Periods: 30**

**TEXT BOOKS:**

1. L. Adinarayana and V. Prakasam, *Spoken English*, Neelkamal Publications Pvt. Ltd., New Delhi, 2008
2. Ram Bhasker Raju, *The Complete Book on Spoken English*, Goutham Buddha Publications, Hyderabad, 2002.

**REFERENCE BOOKS :**

1. Sabina Pillai, *Spoken English for my World,* Oxford University Press, New Delhi, 2016.

2. K. R. Lakshminarayanan, *Speak in English,* Scitech Publications, Chennai, 2009.

**ADDITIONAL LEARNING RESOURCES**

- https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills.
- https://www.fluentu.com/blog/english/websites-to-learn-english/

**I- B. Tech - I/II Semester**

**(19BT1BS02) BIOLOGY FOR ENGINEERS**

(Common to All Branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 2 | - | - | 2 |

**PRE REQUISITE**: --

**COURSE OBJECTIVES:**

- To introduce the molecular basis of life and provide the basis for classification of living organisms
- To describe about biomolecules, enzymes, genes and the transfer of genetic information**.**
- To introduce the techniques used for modification of living organisms and applications of biology**.**

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Apply the basic knowledge of biology to understand the significance of various biological techniques.

CO2. Identify the role of DNA in the molecular basis of information transfer and understand single gene disorders related to the health perspective.

CO3. Apply the basic knowledge of bio-analytical devices and methods to address societal, health and legal issues.

**DETAILED SYLLABUS:**

**UNIT I – LIVING ORGANISMS (6 Periods)**

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy

**UNIT II – PROTEINS, NUCLEIC ACIDS AND ENZYMES (6 Periods)**

Biomolecules, structure and functions of proteins and nucleic acids, Industrial applications of enzymes, Fermentation and its industrial applications

**UNIT III – GENETICS AND MOLECULAR BIOLOGY (6 Periods)**

Mendel's laws, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

**UNIT IV – RECOMBINANT DNA TECHNOLOGY (6 Periods)**

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips

**UNIT V –HUMAN PHYSIOLOGY AND APPLIED BIOLOGY (6 Periods)**

Fundamentals of Human physiology, neurons, synaptic and neuromuscular junctions, Introduction to EEG, DNA fingerprinting, DNA Micro array and Genomics.

**Total Periods: 30**

**TEXT BOOKS**:


1. N. A. Campbell, J. B. Reece, et al., *Biology: A global approach*, Pearson Education Ltd, 2018.
2. S. Sing and T. Allen, *Biology for Engineers*, Vayu Education of India, 2014.


**REFERENCE BOOKS**:


1. B. Alberts, A. Johnson et al., *The molecular biology of the cell*, Garland Science, 6th edition, 2014.

2. A. T. Johnson, *Biology for Engineers*, CRC press, 2011.

**I B. Tech – I Semester (CSE, CSSE, IT, CE & ME)**
**I B. Tech – II Semester (ECE, EEE & EIE)**
**(19BT1HS01) COMMUNICATIVE ENGLISH**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 0 | -- | 3 |

**PRE-REQUISITES: -**

**COURSE OBJECTIVES:**

1. To acquaint with the nuances of effective communication correlating with academic content.
2. To understand and interpret the importance of listening techniques for effective communication.
3. To develop reading and writing techniques for effective technical communication.
4. To make use of speaking techniques to communicate effectively in formal and informal situations.

**COURSE OUTCOMES**: After successful completion of this course, students will be able to:

CO1. Analyze the modes and techniques of listening, speaking, reading, writing and apply appropriately to communicate effectively with the engineering community and society.

**DETAILED SYLLABUS:**

**UNIT I** - **INTRODUCTION TO COMMUNICATION** **(9 periods)**

Introduction – Language as a Tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Modes of Communication – Barriers to Communication (classification) - Case study

**UNIT II** - **ACTIVE LISTENING** **(9 periods)**

Introduction –Traits of a Good Listener – Listening Modes – Types of Listening – Barriers to Effective Listening – Listening for General Content and Specific Information - Case study

**UNIT III** - **EFFECTIVE SPEAKING** **(9 periods)**

Introduction – Achieving Confidence, Clarity and Fluency – Paralinguistic Features – Barriers to Speaking – Types of Speaking – Conferences; significance, planning and preparation and procedure – Symposia and Seminars - Persuasive Speaking - Case study

**UNIT IV - READING (9 periods)**

Introduction – Reading and Interpretation – Intensive and Extensive Reading – Critical Reading ––Techniques for Good Comprehension- SQ3R Reading Technique –Study Skills - Case study

**UNIT V – TECHNICAL WRITING (9 periods)**

Introduction – Language – Elements of Style – Techniques for Good Technical Writing – Paragraphs Construction – Essays: types, Steps to Essay Writing and Checklist – Précis Writing - Case study

**Total Periods: 45**

**TEXT BOOKS**:


**1.** Meenakshi Raman & Sangeetha Sharma, *Technical Communication*, Oxford University Press, New Delhi, 2012.

**2.** Ashraf Rizvi*, Effective Technical Communication*, McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2018.


**REFERENCE BOOKS**:


**1.** Sanjay Kumar & Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi, 2013.

**2.** Rajendra Pal and J. S. Korlahalli, *Essentials of Business Communication*, Sultan Chand and Son, New Delhi, 2010.


**ADDITIONAL LEARNING RESOURCES**

1. https://www.skillsyouneed.com/ips/active-listening.html: A useful summary of what active listening skills are.
2. https://en.wikipedia.org/wiki/Active_listening: Wikipedia entry about active listening.
3. https://www.forbes.com/sites/womensmedia/2012/11/09/10-steps-to-effective-listening/#4b27a2503891: Ten steps to Active Listening (by Forbes magazine).
4. https://goo.gl/t1Uqrt: 20 tips for organizing a conference.
5. https://goo.gl/kPMr9u: 10 important issues for speakers at a conference.
6. https://goo/gl/C5bDvv: Wikihow guide to organizing a conference.

**I B. Tech. – I Semester (CSE, CSSE, IT, CE & ME)**

**I B. Tech. – II Semester (ECE, EEE & EIE)**

**(16BT1HS01) TECHNICAL ENGLISH**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | -- | 3 |

**PRE-REQUISITES:** English at Intermediate level

**COURSE DESCRIPTION:** Introduction to Communication; Active Listening; Effective Speaking; Reading; and Writing.

**COURSE OBJECTIVES:**

**CEO1.** To impart knowledge of the nuances of communication.
**CEO2.** To develop Listening, Speaking, Reading and Writing skills in order to use language effectively in distinct situations.
**CEO3.** To imbibe an attitude of assimilating language skills in the sequence of locating, retrieving, reporting, evaluating, integrating, and accurately citing in the required context.

**COURSE OUTCOMES:** On successful completion of this course, the students will be able to

**CO1:** Demonstrate knowledge in

- Process of communication
- Modes of listening
- Paralinguistic features
- Skimming and Scanning
- Elements of style in writing

**CO2:** Analyze the possibilities and limitations of language, understanding

- Barriers to Communication
- Barriers to Effective Listening
- Barriers to Speaking
- Formal and metaphorical language

**CO3:** Design and develop functional skills for professional practice**.**

**CO4:** Apply writing skills in preparing and presenting documents

**CO5:** Function effectively as an individual and as a member in diverse teams.

**CO6*:*** Communicate effectively with the engineering community and society in formal and informal situations**.**

**DETAILED SYLLABUS:**

**UNIT I** - **INTRODUCTION TO COMMUNICATION: (9 periods)**

Introduction –Language as a Tool of Communication – Communicative Skills (Listening, Speaking, Reading and Writing) – Effective Communication – Modes of Communication – Barriers to Communication (classification)

**UNIT II** - **ACTIVE LISTENING: (9 periods)**

Introduction – Reasons for poor Listening – Traits of a Good Listener – Listening Modes – Types of Listening – Barriers to Effective Listening – Listening for General Content and Specific Information

**UNIT III** - **EFFECTIVE SPEAKING: (9 periods)**

Introduction – Achieving Confidence, Clarity and Fluency – Paralinguistic Features – Barriers to Speaking – Types of Speaking – Persuasive Speaking

**UNIT IV** - **READING**: **(9 periods)**

Introduction and Reading Rates – Reading and Interpretation – Intensive and Extensive Reading – Critical Reading – Reading for Different Purposes – SQ3R Reading Technique – Study Skills

**UNIT V** – **WRITING**: **(9 periods)**

Introduction – Language – Elements of Style – Techniques for Good Technical Writing – Referencing and Styling – Right Words and Phrases – Sentences

**Total Periods: *45***

**TEXT BOOKS**:

1. Meenakshi Raman & Sangeetha Sharma, *Technical Communication*, Oxford University Press, New Delhi, 2012.

**REFERENCE BOOKS**:

**1.** Ashraf Rizvi*, Effective Technical Communication*, McGraw-Hill Education (India) Pvt.Ltd., New Delhi, 2015.

**2.** Sanjay Kumar & Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi, 2013.

**3.** Teri Kwal Gamble and Michael Gamble, *Communication Works*, Tata Mc Graw-Hill, New Delhi, 2010.

**4.** Rajendra Pal and J.S. Korlahalli, *Essentials of Business Communication*, Sultan Chand and Son, New Delhi, 2010.

**I B. Tech. - I/II Semester**
**(**19BT1BS03**) ENGINEERING PHYSICS**
(Common to CSE, CSSE, ECE, EEE, EIE & IT Branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 0 | -- | 3 |

**PRE-REQUISITES: -**

**COURSE OBJECTIVES:**

1 To impart knowledge in basic concepts of wave optics, electromagnetic theory and fiber optics.
2 To identify the importance of semiconductors in the functioning of opto-electronic devices.
3 To familiarize the properties and applications of dielectric, magnetic , superconducting and
nanomaterials relevant to engineering branches.

**COURSE OUTCOMES:** After successful completion of the course, a student will be able to:

**CO1.** Apply the knowledge of light waves to interpret the concepts of Interference, Diffraction and Polarization.

**CO2.** Demonstrate the concepts of electromagnetic wave propagation in Optical fibers.

**CO3.** Apply the basic knowledge of semiconductors to understand the functioning of various optoelectronic devices.

**CO4.** Demonstrate the basic knowledge of dielectric and magnetic properties to understand the various dielectric polarizations and magnetic materials.

**CO5.** Understand the concepts of superconductors and nanomaterials to familiarize their applications in relevant fields.

**DETAILED SYLLABUS:**

**UNIT-I: WAVE OPTICS (09 periods)**

Interference: Principle of superposition - Interference of light - Theory of interference fringes - Conditions for sustained interference - Interference in thin films (reflected light) - Newton's rings - Determination of wavelength.

Diffraction: Fraunhofer diffraction - Single slit diffraction - Diffraction grating - Grating spectrum - Determination of wavelength.

Polarization: Polarization by reflection, refraction and double refraction - Nicol's prism - Half wave and Quarter wave plate - Engineering applications of interference, diffraction and polarization.

**UNIT-II: ELECTROMAGNETIC WAVES AND FIBER OPTICS (10 periods)**

Divergence, Curl of Electric and Magnetic Fields - Maxwell's Equations (qualitative) - Electromagnetic wave propagation (conducting and non conducting media).

Introduction to fiber optics - Total Internal Reflection - Critical angle of propagation - Acceptance angle, Acceptance cone - Numerical Aperture - Classification of fibers based on Refractive index profile, modes - Attenuation losses - Dispersion - Propagation of electromagnetic wave through optical fiber - Block diagram of fiber optic communication - Applications of an optical fiber - Fiber optic Sensors (temperature, displacement).

**UNIT-III: SEMICONDUCTORS (10 periods)**

Origin of energy bands - Classification of solids based on energy bands - Intrinsic semiconductors - Density of electrons in intrinsic semiconductor - Density of holes in intrinsic semiconductor (qualitative) - Intrinsic carrier concentration - Fermi energy - Electrical conductivity of intrinsic semiconductors - Extrinsic semiconductors - Density of charge carriers in n-type - Density of charge carriers in p-type (qualitative) - Direct and Indirect band gap semiconductors - Hall effect, Hall coefficient - Applications of Hall effect - Drift and Diffusion currents - pn junction - Semiconducting materials for optoelectronic devices : Photodiode and Semiconductor diode laser.

**UNIT-IV: DIELECTRICS AND MAGNETISM (09 periods)**

Introduction to dielectrics - Electric polarization - Dielectric polarizability, susceptibility and dielectric constant - Types of polarizations (qualitative) - Frequency dependence of polarization - Lorentz (internal) field - Dielectric break down - Piezoelectricity - Applications of dielectrics.

Introduction to magnetics - Magnetic dipole moment, magnetization, magnetic susceptibility and permeability - Origin of magnetic moment - Classification of magnetic materials - Hysteresis loop - Soft and hard magnetic materials.

**UNIT-V: SUPERCONDUCTORS AND NANOMATERIALS (7 periods)**

Introduction to Superconductors, Properties - Critical parameters of Superconductors - Meissner effect - Penetration depth - Types of Superconductors - BCS Theory - Josephson effect (AC & DC) - High $T_C$ Superconductors - Applications.

Basic principles of nanomaterials - Synthesis of nanomaterials by PLD method - Properties of nanomaterials - Applications of nanomaterials.

**Total Periods: 45**

**TEXT BOOKS:**


1. M.N. Avadhanulu, P.G.Kshirsagar & T.V.S Arun Murthy, *A Text book of Engineering Physics*, S. Chand Publications, 11th edition, 2019.
2. P. K. Palaniswamy, *Engineering Physics*, Scitech Publications India Private Limited, 2nd edition, 2009.


**REFERENCE BOOKS:**


1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.

**I B. Tech. – I/II Semester**

**(16BT1BS02) ENGINEERING PHYSICS**

(Common to all branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | -- | 3 |

**PRE-REQUISITES:** Intermediate / senior secondary Physics

**COURSE DESCRIPTION:**

Lasers; optical fibers; principles of quantum mechanics; band theory of solids; semiconductors; dielectric properties of materials; acoustics of buildings; superconductors; crystallography and nanomaterials.

**COURSE OBJECTIVES:**

CEO1 : To provide the basic knowledge of architectural acoustics, quantum mechanics, lasers, superconductors, optical fibers, semiconductors and nanotechnology.

CEO2 : To develop skills in using semiconductor devices, lasers, and optical fibers.

**COURSE OUTCOMES:** After completion of the course, a successful student will be able to:

CO1: Acquire basic knowledge of lasers, optical fibers, quantum mechanics, dielectrics, semiconductors, and superconductors, acoustic of buildings, crystallography and nanomaterials.

CO2: Analyze the construction and working of various laser systems, semiconductor devices, various types of optical fibers and its communication system and nano materials properties.

CO3: Gain skills in designing of lasers, optical fiber cable, semiconductor devices, acoustically good halls and nanomaterials.

CO4: Develop problem solving skills in engineering context.

CO5: Use relevant techniques for assessing ball milling, pulsed laser deposition, pn-junction, Laser

**DETAILED SYLLABUS:**

**UNIT I – LASERS AND FIBER OPTICS**

**(11periods)**

**Lasers:** Introduction, characteristics of lasers, spontaneous and stimulated emission of radiation, Einstein's coefficients – condition for amplification, population inversion, Nd:YAG laser, Helium-Neon laser, semiconductor laser and applications of lasers.

**Fiber optics:** Introduction, principle of optical fiber, acceptance angle, acceptance cone and numerical aperture, classification of optical fibers optical fiber communication system and applications of optical fibers.

**UNIT II – PRINCIPLES OF QUANTUM MECHANICS AND BAND THEORY OF SOLIDS (07 periods)**

**Principles of Quantum Mechanics:** Introduction, de-Broglie's hypothesis, Schrödinger's one dimensional wave equation (time independent), significance of wave function, particle in a one dimensional potential box, Fermi-Dirac distribution and effect of temperature (qualitative treatment).

**Band Theory of Solids:** Electron in a periodic potential, Kronig-Penney model (qualitative treatment), origin of energy bands formation in solids, distinction between conductors, semiconductors and insulators based on band theory.

**UNIT III – SEMICONDUCTORS AND DIELECTRIC PROPERTIES OF MATERIALS (13 periods) Semiconductors:** Introduction, types of semiconductors, intrinsic carrier concentration, electrical conductivity in semiconductors, drift and diffusion currents, Einstein's relation, Hall effect and its applications, direct and indirect band gap semiconductors, p-n junction, energy band diagram of p-n diode, LED, photo diode and Solar cell.

**Dielectric Properties of Materials:** Introduction, dielectric constant, electronic, ionic and orientation polarizations (qualitative treatment), local field, frequency dependence of polarizability (qualitative treatment), ferroelectricity.

**UNIT IV – ACOUSTICS OF BUILDINGS AND SUPERCONDUCTIVITY (07 periods)**

**Acoustics of Buildings:** Introduction, basic requirement of acoustically good hall, reverberation and time of reverberation, Sabine's formula for reverberation time (qualitative treatment), absorption coefficient of sound and its measurement, factors affecting the architectural acoustics and their remedies.

**Superconductivity:** Introduction, General properties - Meissner effect, penetration depth, Type-I and Type-II superconductors, flux quantization, Josephson effects, BCS theory (qualitative treatment), applications of superconductors.

**UNIT V – CRYSTALLOGRAPHY AND NANOMATERIALS (07 periods)**

**Crystallography:** Introduction, crystal planes, crystal directions and Miller indices, separation between successive (hkl) planes, X-ray diffraction by crystal planes, Bragg's

law- powder method. **Nanomaterials:** Introduction, principles of nanomaterials, properties of nanomaterials, synthesis of nanomaterials by ball milling and pulsed laser deposition and applications of nanomaterials.

**Total Periods: 45**

**TEXT BOOKS**:

1. P. K. Palaniswamy, ***Engineering Physics***, Scitech Publications India Private Limited, 2nd Edition, 2009

**REFERENCE BOOKS**:

1. Dr. S. Mani Naidu*,* ***Engineering Physics***, Pearson Education, 1st Edition, 2013.
2. M.N. Avadhanulu,P.G.Kshirsagar, ***A textbook of Engineering Physics***, S.Chand & Company Ltd. Revised edition 2014.
3. K. Thyagarajan***,*** ***Engineering Physics-I***, McGraw-Hill Education (India) Pvt.Ltd. 2015

**I B. Tech. - I/II Semester**

(19BT1BS31**) ENGINEERING PHYSICS LAB**
(Common to CSE, CSSE, ECE, EEE, EIE & IT Branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE REQUISITE:** --
**COURSE OBJECTIVES**:

1 To impart knowledge in basic principles of optical, electrical and electronic instrumental techniques.
2 Develop skills in the design and functioning of components in the electronic circuits.
3 Develop the practical skills in analyzing optical, electrical and electronic properties of materials using different instruments for engineering applications.
4 Imbibe scientific attitude in applications of various experiments.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Apply the basic knowledge of light waves and semiconductors to demonstrate the functioning of optoelectronic devices.
**CO2.** Understand the experimental procedures to calculate the thickness of a thin film, Hall coefficient, Hysteresis losses, and acceptance angle of an optical fiber.
**CO3.** Determine the experimental values of magnetic field induction, wave length of a light source, energy gap of a semiconductor.
**CO4.** Apply skills to plot characteristic curves to determine the various parameters of semiconductor diodes.
**CO5:** Work independently and in teams to solve problems with effective communication.

A minimum of any **Ten** experiments are to be conducted among the following:
**LIST OF EXPERIMENTS:**

1. Determine the thickness of the wire using wedge shape method.
2. Determination of wavelength of light source by Newton's ring method.
3. Determination of wavelength by plane diffraction grating method.
4. Estimation of magnetic field along the axis of a circular coil carrying current.
5. Study the variation of Magnetic field induction (B) vs Magnetic field strength (H) by magnetizing the magnetic material (B-H Curve).
6. Determination the numerical aperture of a given optical fiber and hence to estimate its acceptance angle.
7. Determination of number of charge carriers and Hall coefficients of a given semiconductor using Hall Effect.
8. Determine the resistivity of semiconductor by Four probe method.
9. Determine the energy gap of a semiconductor.
10. Study the I-V characteristics of pn junction diode.
11. Estimation of threshold voltages of different LED's.
12. Study the characteristics of Photodiode.

13. Determination of wavelength of laser by using diffraction grating.

**REFERENCES:**

1. S. Balasubramaniah and M.N. Srinivasan, *A Text book of practical physics*, S Chand Publications, 2017.
2. *http://vlab.amrita.edu/index.php* - Virtual Labs, Amrita University.

**I B. Tech. – Semester**

**(16BT1BS32) ENGINEERING PHYSICS LABORATORY**

(Common to all Branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 0 | 0 | 3 | 2 |

**PRE-REQUISITES:** Intermediate / senior secondary Physics.

**COURSE DESCRIPTION:**

Characteristics of p-n junction diode, Photodiode, LED, and semiconductor laser diode. Experimental determination of carrier concentration and energy gap of a semiconductor material, wave length of a laser source, size of fine particle, numerical aperture and acceptance angle of optical fiber. Determination of frequency of electrically vibrating tuning fork and a.c source using a.c sonometer, magnetic field along axial line of a current carrying coil and rigidity modulus of material of a wire using torsional pendulum.

**COURSE OBJECTIVES:**

CEO 1: Develop skills in the design and functioning of components in the electronic circuits.

CEO 2: Develop the practical skills in analyzing optical, electrical, electronic and mechanical properties of materials using different instruments for engineering applications.

CEO 3: Imbibe scientific atitude in applications of various experiments.

**COURSE OUTCOMES:** After completion of the course, a successful student will be able to:

**CO1:** Acquire basic knowledge about semiconductor materials, magnetic materials and lasers.

**CO2:** Acquire analytical skills in the estimation of carrier concentration of semiconductor materials and characterization of p-n junction.

**CO3:** Develop skills in designing electronic circuits using semiconductor components.

**CO4:** Acquire skills to use instrumental techniques in ac sonometer and Melde's experiment.

**CO5**: Apply diffraction techniques for determination of size of tiny particles and wave length of lasers.

**LIST OF EXCERSICES:**

Conduct a minimum of any **Ten** of the following experiments.

1. Determination of wavelength of a laser source using Diffraction Grating.
2. Determination of particle size by using a laser source.
3. Determination of Numerical aperture and acceptance angle of an optical fiber.

4. Melde’s experiment - transverse & longitudinal modes.
5. Magnetic field along the axis of a current carrying coil- Stewart and Gee’s method.
6. Calculation of ac frequency using sonometer.
7. I-V Characteristics of a p-n Junction diode.
8. Energy gap of a material of a p-n Junction.
9. Characteristics of LED source.
10. Characteristics of Photo diode.
11. Hall Effect.
12. Determination of rigidity modulus of the material of the wire using torsional pendulum.

**I B. Tech. - I/II Semester**
**(**19BT1BS04**) ENGINEERING CHEMISTRY**
(Common to All Branches)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE REQUISITE**: -

**COURSE OBJECTIVES:**

1 To provide basic knowledge in quantum-mechanical model of atom, bonding theories, water treatment, electrochemistry, corrosion, instrumental methods, fuels and lubricants.

2 To develop skills in identification of molecular shapes, measurement of hardness of water, calculation of cell potential, calorific value of fuels.

3 To impart basic knowledge pertains to various instrumental methods, their applications and characterization of molecular structures using instrumental methods.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Apply the basic knowledge of quantum mechanical approach to atomic structure and bonding theories to identify shapes of different orbitals and molecules.

CO2. Analyze and solve problems associated with hardness of water, boiler troubles and address the societal, health and safety issues related to quality of water.

CO3. Apply the basic knowledge of corrosion phenomenon to identify solutions for control of corrosion and demonstrate competency in the basic concepts of electrochemical cells.

CO4. Demonstrate the basic knowledge of instrumental methods and their applications in the structural analysis of materials.

CO5. Apply the basic knowledge of fuel chemistry and lubricants to identify the quality of fuels and lubricants.

**DETAILED SYLLABUS:**

**Unit I: Atomic Structure and Bonding Theories (9 periods)**

Quantum-mechanical model of atom, Schrodinger wave equation, significance of Ψ and $\Psi^2$ , applications to particle in a box and hydrogen atom; Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of $N_2$,

$O_2$, NO and CO; Π-molecular orbitals of butadiene and benzene; VSEPR theory and molecular shapes.

**Unit II: Water Treatment (9 periods)**

Introduction, types of water, Impurities in water and their consequences. Hardness of water, units of hardness, disadvantages of hardness, measurement of hardness by EDTA method, numerical problems on measurement of hardness of water, boiler troubles- priming & foaming, scales & sludge, caustic embrittlement, boiler corrosion, softening of water– Ion exchange process, zeolite process, desalination of brackish water by reverse osmosis, Drinking water treatment- Ozonisation & chlorination, specifications of potable water as per WHO and BIS standards. Fluoride in ground water: Effects on human health, defluoridation method – Nalgonda method; merits and demerits of various defluoridation methods.

**Unit III: Electrochemistry and Applications (10 periods)**

Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode), electrochemical cell, cell potential calculations. Primary cells – dry cell, alkali metal sulphide batteries, Secondary cells – lead acid, lithium ion batteries, Fuel cells - Hydrogen-oxygen fuel cell, Methanol-oxygen fuel cell, Solid-oxide fuel cell.

**Corrosion:** Introduction, Definition, types of corrosion- wet (galvanic corrosion, concentration cell corrosion) and dry corrosion, Factors influencing corrosion, control of corrosion- sacrificial anodic protection, Impressed current cathodic protection, electroplating method (Nickel).

**Unit IV: Instrumental Methods and Applications (9 periods)**

Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle, types of electronic transitions, chromophore, auxochrome, Bathochromic shift, Hypsochromic shift, Instrumentation of UV-Vis spectrophotometer, applications; Infrared spectroscopy – principle, types of vibrational modes, group frequencies, Instrumentation of IR spectrophotometer, applications. principle and applications of physicochemical methods (SEM, TEM, X-ray diffraction).

**Unit V: Fuel chemistry and Lubricants (8 Periods)**

**Fuel chemistry**: Types of fuels, calorific value, numerical problems based on calorific value; Liquid fuels, cracking of oils (Thermal and Fixed-bed catalytic cracking), knocking and anti-knock agents, Octane and Cetane values, Synthetic petrol: Fischer-Tropsch method and Bergius process.

**Lubricants**: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity and viscosity index , flash and fire

points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

**Total Periods: 45**

**TEXT BOOKS:**

1. P. C. Jain & Monika Jain*, Engineering Chemistry*, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K.N. Jayaveera, G.V. Subba Reddy and C. Ramachandriah, *Engineering Chemistry,* Mc.Graw Hill Publishers, New Delhi.

**REFERENCE BOOKS:**


1. J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.

**I-B. Tech - I/II Semester**
**(16BT1BS01): ENGINEERING CHEMISTRY**
(Common to All Branches of Engineering)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | - | 3 |

**PRE REQUISITE**: Intermediate/Senior Secondary Chemistry

**COURSE DESCRIPTION**: Water technology, Chemistry of Engineering materials, Nano Chemistry, Green Chemistry, Electro chemical cells, Sensors, Corrosion and Lubricants.

**COURSE OBJECTIVES:**

1. To impart basic and applied knowledge in water technology, Chemistry of Engineering materials, Nano Chemistry, Green Chemistry, bio-diesel, electro chemical cells, sensors, corrosion and lubricants.

2. To develop skills in analysis of materials and design of systems for engineering applications.

3. To imbibe an attitude among students to practice Engineering in compliance with principles of Green Chemistry.

**COURSE OUTCOMES:** After completion of the course, a successful student is able to:

1. Acquire basic knowledge in water technology, engineering plastics, conducting polymers, composites, Electro chemical cells, Nano Chemistry, principles of Green Chemistry, corrosion phenomenon and lubricants.
2. Develop analytical skills in:
   a. Determination of hardness of water.
   b. Determination of viscosity, flame and fire points, cloud and pour points.
3. Develop designing skills in:
   a. Synthesis of engineering plastics.
   b. Chemical methods for the synthesis of Nano materials.
4. Develop skills for providing solutions through:
   a. Mitigation of hardness of water.
   b. Newer Nanomaterials and engineering plastics for specific applications
5. Acquire awareness to practice engineering in compliance to modern techniques such as:
   a. Nalgonda technique for defluoridation of water
   b. Electroplating technique for control of corrosion.
6. Acquire awareness to societal issues on:
   a. Quality of water.
   b. Bio-diesel
   c.Chemical materials utility and their impact.

**DETAILED SYLLABUS:**

**UNIT–I: WATER TECHNOLOGY [9 periods]**

Introduction, types of water, impurities in water and their consequences, types of hardness of water, units of hardness of water, disadvantages of hardness of water, estimation of hardness of water by EDTA method, Boiler troubles: Scales and Sludges, Caustic embrittlement, Boiler corrosion and Priming and Foaming. Softening of water: Zeolite process and Ion exchange process, advantages and disadvantages. Desalination of brackish water by Reverse Osmosis, Numerical problems on estimation of hardness of water.

Fluorides in water: effects on human health, defluoridation method-Nalgonda method; comparison of merits and demerits of various defluoridation methods (Nalgonda, Bone Charcoal, Activated Alumina, Contact precipitation, Brick, Reverse osmosis).

**UNIT – II: CHEMISTRY OF ENGINEERING MATERIALS [9 periods]**

**Engineering Plastics:** Definition, general properties, synthesis, properties and applications of PC, PTFE, and PMMA.

**Conducting polymers**: Definition, types of conducting polymers: Intrinsic and extrinsic conducting polymers with examples, engineering applications of conducting polymers.

**Biodegradable polymers**: Definition, properties, classification, mechanism of degradation of biodegradable polymers and their applications.

**Composites** – Introduction, types of composites: fiber reinforced particulate and layered composites with examples, advantages of composites and applications.

**UNIT– III: NANO CHEMISTRY AND GREEN CHEMISTRY [9 periods]**

**Nano Chemistry:** Introduction, classification, properties and applications of Nano materials (nano particles, nano tubes, nano wires, nano composites, dendrimers); synthesis of Nano materials – Sol-gel process.

**Green Chemistry:** Introduction, principles of green chemistry, Tools of Green Chemistry with Examples, Applications of Green Chemistry in science and technology.

**Biodiesel:** Introduction, Synthesis (Trans esterification method), advantages, disadvantages and applications.

**UNIT–IV: ELECTROCHEMICAL CELLS AND SENSORS [9 periods]**

**Electrochemical cell**: Introduction, EMF of an electrochemical cell.

**Batteries:** Introduction, types of Batteries: primary and secondary batteries with examples, Ni-Cd batteries, Lithium-ion batteries, Lithium- Polymer batteries, Applications of batteries.

**Fuel Cells:** Definition, examples: $H_2 - O_2$ Fuel cell, solid oxide fuel cell, Bio-fuel cell and applications of fuel cells.

**Sensors** - Introduction, Types of Sensors, electrochemical sensor: construction and working principle of potentiometric sensor, and applications of electrochemical sensors.

**UNIT–V: CORROSION AND LUBRICANTS [9 periods]**

**Corrosion:** Introduction, Definition, types of corrosion (dry and wet corrosion), galvanic corrosion, concentration cell corrosion, Factors influencing corrosion, Corrosion control: cathodic protection; sacrificial anodic protection and impressed current cathodic protection; protective coatings: Galvanizing and Electroplating (Nickel).

**Lubricants:** Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity, flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

**Total periods: 45**

**TEXT BOOKS:**


1. P.C.Jain & Monika Jain, **Engineering Chemistry**, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K.N. Jayaveera, G.V. Subba Reddy & C. Ramachandraiah **Engineering Chemistry**, Mc. Graw-Hill Higher Education, Hyderabad, 1st edition, 2015.


**REFERENCE BOOKS:**


1. A.K. Bandyopadhyay, **Nano Materials,** New Age international publishers, 2nd edition, 2014.
2. Paul T. Anastas, John C Warner, **Green Chemistry: Theory and practice,** Oxford University Press, 2000

**I B.Tech. - I/II Semester**

**(**19BT1BS32**) ENGINEERING CHEMISTRY LABORATORY**

(Common to All Branches of Engineering)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE REQUISITE:** -

**COURSE OBJECTIVES:**

- To impart knowledge in basic principles of volumetric and instrumental methods of analysis.
- To develop practical skills encompassing quantitative analysis of materials by volumetric methods.
- To develop practical skills to analyze the materials by instrumental methods.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Apply analytical skills for the quantitative estimation of materials through volumetric methods of analysis and address the societal, health issues related to quality of water.

CO2. Develop analytical skills for the quantitative estimation of materials through instrumental methods of analysis.

CO3. Work independently and in teams to solve problems with effective communication.

A minimum of any **Ten** experiments are to be conducted among the following:

**LIST OF EXPERIMENTS :**

1. Estimation of Hardness of water by EDTA method
2. Determination of alkalinity of Water sample
3. Estimation of Dissolved Oxygen in water by Winkler's method.
4. Estimation Fe (II) by Dichrometry
5. Conductometric titration of strong acid Vs strong base
6. Estimation of Ferrous ion by Potentiometry
7. Determination of strength of acid by $P^H$ metric method
8. Determination of Strength of an acid in Pb-Acid battery
9. Determination of Viscosity by Ostwald's viscometer
10. Determination of percentage of Iron in Cement sample by colorimetry
11. Estimation of residual chlorine in drinking water.
12. Identification of simple organic compounds by UV-Vis and IR spectroscopy

**TEXT BOOKS:**


1. K. Mukkanti, *Practical Engineering Chemistry*, BS Publications, 2013.
2. K.N. Jayaveera, K.B. Chandra Sekhar, *Chemistry laboratory manual*, S.M. Enterprises Limited, 2013.

**I-B. Tech- I/II Semester**

**(16BT1BS31): ENGINEERING CHEMISTRY LABORATORY**

(Common to All Branches of Engineering)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | - | - | 3 | 2 |

**PRE REQUISITE:** Intermediate/Senior Secondary Chemistry

**COURSE DESCRIPTION:** Estimation of hardness, alkalinity, dissolved oxygen of water samples and estimation of Iron by volumetric methods, determination of effect of $P^H$ on rate of corrosion, measurement of viscosity of lubricants; Instrumental methods like potentiometer, conductivity meter, $P^H$ meter and colorimeter; synthesis of Polymers and Nano materials.

**COURSE OBJECTIVES:** This course enables the students to:

1. Develop practical skills encompassing quantitative analysis of materials by volumetric methods, instrumental methods and acquire designing skills for the synthesis of Nano materials and Engineering plastics.

**COURSE OUTCOMES:** After completion of the course, a successful student is able to:

1. Acquire basic knowledge about the volumetric analysis and synthesis of materials used for engineering applications**.**
2. Acquire analytical skills in the estimation of hardness of water, alkalinity of water, dissolved oxygen in water and estimation of Iron through wet laboratory methods.
3. Develop designing skills for the synthesis of polymers and Nanomaterials.
4. Acquire skills to use instrumental techniques for the determination of Electrical conductance of electrolytes, EMF of a cell, $P^H$ of a solution, determination of viscosity of lubricants and estimation of iron in cement.
5. Provide solutions for environmental issues through determination of quality of water.

A minimum of any **Ten** experiments are to be conducted among the following:

**LIST OF EXPERIMENTS:**

1. Estimation of Hardness of water by EDTA method.

2. Estimation of alkalinity of Water.
3. Estimation of Dissolved Oxygen in water.
4. Estimation of Ferrous Iron by Dichrometry.
5. Preparation of Novalac Resin.

6. Synthesis of Nano metal-oxide using sol– gel process.
7. Conductometric titration of strong acid Vs strong base
8. Estimation of Ferrous ion by Potentiometry.
9. Determination of amount of corrosion of metals in different medium
10. Measurement of viscosity of lubricants by Ostwald viscometer.
11. Determination of $P^H$ of a given solution by $P^H$ metry.
12. Estimation of Ferric iron in cement by Colorimetric method.

**Duration: 3 Periods for each experiment**

**Total periods: 36**

**TEXT BOOKS:**


1. K. Mukkanti, *Practical Engineering Chemistry*, BS Publications, 2013.

2. K.N. Jayaveera, K.B. Chandra Sekhar, *Chemistry laboratory manual*, S.M. Enterprises Limited, 2013.

**I B. Tech. – II Semester**

**(19BT2BS02) APPLIED PHYSICS**

(Common to Civil and Mechanical Engineering)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 0 | -- | 3 |

**PREREQUISITES**: --

**COURSE OBJECTIVES:**

- To impart fundamental knowledge in the area of mechanics, acoustics, ultrasonics, dynamic motion of a particle, heat energy and modern materials.
- To familiarize the application of modern materials and sensors to civil and mechanical engineering.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Apply the basic knowledge of fiber optics, acoustics and ultrasonics to provide solutions for various engineering problems.

CO2. Analyze and solve the problems associated with kinetics, kinematics and thermal physics.

CO3. Demonstrate the knowledge on characteristics and applications of modern engineering materials.

**DETAILED SYLLABUS:**

**Unit-I: FIBER OPTICS (8 periods)**

Introduction, structure of an optical fiber, total internal reflection, acceptance angle, acceptance cone and numerical aperture, modes of propagation, classification of optical fibers, V-number (qualitative), fabrication of optical fiber by double crucible technique, applications of optical fibers, sensors (temperature, displacement, liquid level detector).

**UNIT-II: ACOUSTICS AND ULTRASONICS (9 periods)**

**Acoustics** - Introduction, classification of sound, sound intensity level (decibel), reverberation, reverberation time, absorption coefficient and its determination, Sabine's formula (qualitative), factors affecting acoustics and their remedies, basic requirements of an acoustically good hall.

**Ultrasonics** - Introduction to ultrasonic waves, production of ultrasonic waves by piezoelectric method, magnetostriction method, detection of ultrasonics (qualitative), industrial applications (ultrasonic welding, ultrasonic soldering and ultrasonic drilling).

**UNIT-III: KINEMATICS AND KINETICS (10 periods)**

**Kinematics of particles** - Rectilinear motion (displacement-time curve, velocity-time curve, acceleration-time curve), curvilinear motion (velocity and angle of projection, equation of trajectory path, horizontal range) - inclined projection (equation of trajectory, maximum height, time of flight of projectile, horizontal range, angle of projection).

**Kinetics** - Bodies in rectilinear translation, kinetics of bodies rotating about fixed axis, work, energy, power, work-energy equation for translation.

**UNIT-IV: THERMAL PHYSICS (8 periods)**

Introduction, modes of heat transfer (conduction, convection and radiation), coefficient of thermal conductivity, rectilinear flow of heat along a uniform bar, thermal conductivity of bad conductor (Lee's disc method), heat conduction through compound media (materials in series and parallel).

**UNIT V: MODERN ENGINEERING MATERIALS (10 periods)**

**Metallic glasses** - Introduction, preparation of metallic glasses by RF sputtering technique, properties (structural, thermodynamic, mechanical, electrical, chemical and optical), applications of metallic glasses.

**Shape memory alloys (SMA)** – Introduction, shape memory effect and its types, characteristics of SMA, properties of NiTi alloy, applications of SMA.

**Composites** - Introduction, types and applications.

**Total periods: 45**

**TEXT BOOKS:**


1. M. N. Avadhanulu, P. G. Kshirsagar, T. V. S. Arun Murthy, *A Textbook of Engineering Physics* - S. Chand Publications, 11th edition, 2019.
2. S. S. Bhavikatti and K. G. Rajashekarappa, *Engineering Mechanics*, New Age International Publishers, 2nd edition, 2015.


**REFERENCE BOOKS:**


1. B. K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Learning, 2012.
2. Brij Lal and N. Subrahmanyam, *Heat and Thermodynamics,* S. Chand and Company Ltd., 1995.

**I B. Tech. – II Semester**

(19BT2BS31) **APPLIED PHYSICS LAB**

(Common to Civil and Mechanical Engineering)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE REQUISITE:** --

**Course Objectives:**

- To gain practical knowledge in all experiments by correlating with the theoretical concepts in Physics.
- To analyze and interpret experimental data along with graphical analysis.
- To discuss the basic principles of scientific concepts in various engineering branches.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1**. Demonstrate the experimental procedures to compute the frequency of a tuning fork, hall coefficient, energy gap, moment of inertia, rigidity modulus and thermal conductivity of materials.

**CO2**. Apply skills to plot various characteristic curves of an optical Fiber and also determine thermal conductivity, thermo emf and energy gap.

**CO3**. Work independently and in teams to solve problems with effective communication.

A minimum of **Ten** experiments are to be conducted among the following:

**LIST OF APPLIED PHYSICS EXPERIMENTS:**

1. Determination of moment of inertia of a bar and acceleration due to gravity - Compound Pendulum.
2. Moment of inertia of a Flywheel.
3. Bifilar Pendulum - Moment of inertia of a rectangular body.
4. Melde's Experiment – Determine the frequency of electrically driven tuning fork.
5. Determination of thermal conductivity of a good conductor (Forbe's Apparatus).
6. Determination of thermal conductivity of a bad conductor (Lee's disc method).

7. Thermal Expansion of Solids - Bimetallic Strip.
8. Study of characteristics of an optical sensor.
9. Verification of Newton's Law of Cooling for any two liquids.
10. Determination of number of charge carriers per unit volume and hall coefficients of a given material using Hall Effect.
11. Rigidity Modulus of a material of a wire - Torsional Pendulum
12. Thermocouple - Seebeck Effect.
13. Determine the energy gap of a material by varying temperatures.

**REFERENCES:**


1. Balasubramanian S, Srinivasan M.N and Ranganathan, *A Text book of Practical Physics,* R, Sultan Chand & Sons, 2017.
2. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=354&cnt=1

**I B. Tech. - II semester**

(19BT2BS01) **TRANSFORMATION TECHNIQUES AND LINEAR ALGEBRA**

**(Common to All Branches)**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 1 | -- | 4 |

**PRE-REQUISITE:** -

**COURSE OBJECTIVES:**

- To familiarize with Fourier series of a periodic function, the Fourier integral of a function and the Fourier transformation.
- To introduce Laplace transform techniques for solving differential equations.
- To acquaint the students with concepts of matrices and linear transformations useful in engineering contexts.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1: Apply the knowledge of Fourier and Laplace transform techniques to solve differential equations.

CO2: Analyze linear transformations and associated matrices to solve engineering problems by applying the knowledge of linear algebra.

**DETAILED SYLLABUS:**

**UNIT- I: Fourier Series and Fourier Transforms (9 Periods)**

Fourier series: Determination of Fourier coefficients, Euler's formulae, convergence of Fourier series (Dirichlet's conditions), Fourier series in $(0,2l),(-l,l)$; Fourier series of even and odd functions; Half-range Fourier sine and cosine expansions in $(0,l)$; Fourier integral theorem (statement only), Fourier sine and cosine integrals; Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.

**UNIT-II: Laplace Transforms (9 Periods)**

Definition of Laplace transform, existence conditions, Laplace transform of standard functions, Properties of Laplace transforms, Laplace Transforms of derivatives, Laplace Transforms of integrals, multiplication by $t^n$, division by t, Laplace transform of periodic functions, Laplace transforms of unit step function and unit impulse function.

**UNIT- III: Inverse Laplace Transforms (9 Periods)**

Inverse Laplace transform by different methods; Convolution theorem (without proof), inverse Laplace transforms by convolution theorem; Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

**UNIT- IV: Linear Algebra-I (Matrices) (9 Periods)**

Rank of a matrix: echelon form; Linear systems of equations: solving system of Homogeneous and Non-Homogeneous equations; Eigen values and Eigen vectors of a matrix and properties (without proofs), Diagonalization of matrix by orthogonal transformation; Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT- V: Linear Algebra-II (Vector Spaces) (9 Periods)**

Vector spaces, Linear dependence and independence of vectors, basis, dimension, Linear transformations (maps), range and kernel of a linear map, rank and nullity, inverse of a linear transformation, rank-nullity theorem (without proof), matrix associated with a linear map.

**Total Periods: 45**

**TEXT BOOKS:**


1. T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, *Engineering Mathematics-II*, S. Chand & Company, 10th edition, 2016.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
3. David Poole, *Linear Algebra: A Modern Introduction*, Brooks/Cole, 2nd edition, 2005.


**REFERENCE BOOKS**:


1. B.V. Ramana, *Higher Engineering Mathematics*, Tata McGraw hill, 1st edition, 2017.
2. V.Krishna Murthy, Mainra and Arora: *An Introduction to Linear Algebra*, Affiliated East-West Press, 1993.

**I B. Tech. – II Semester**

## (16BT2BS01) TRANSFORMATION TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

**(Common to all Branches of Engineering)**

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | -- | 3 |

**PRE REQUISITE**: Intermediate /Senior secondary mathematics

**COURSE DESCRIPTION**: Fourier series; Fourier integrals and transforms; Laplace transforms; z –transforms; partial differential equations.

**COURSE OBJECTIVES:**

CEO 1 :To impart basic knowledge on Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations.

CEO 2 :To develop skills in analyzing the problems ,designing mathematical models, Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations for the problems in engineering.

**COURSE OUTCOMES:** After completion of the course a successful student is able to

CO 1 :Acquire basic knowledge in
- (a) Fourier series and Fourier transforms
- (b) Fourier integrals
- (c) Laplace transforms and their applications
- (d) z- transforms and their applications
- (e) solving partial differential equations
- (f) Heat transfer and wave motion

CO 2 : Develop skills in analyzing the
- (a) Properties of Fourier series for a given function
- (b) Partial differential equations through different evaluation methods
- (c) Difference equations through z – transforms
- (d) Engineering systems and processes involving wave forms and heat transfer

CO 3 :Develop skills in designing mathematical models for
- (a) Problems involving heat transfer and wave forms
- (b) Engineering concepts involving, Fourier transforms, Fourier integrals, Laplace transforms, z-transforms and difference equations

CO 4 :Develop analytical skills in solving the problems involving
- (a) Fourier series and Fourier transforms
- (b) Laplace transforms

(c) Z-transforms and difference equations
(d) Heat transfer and wave motion

CO 5 : Use relevant transformation techniques for
(a) Obtaining Fourier transforms for different types of functions
(b) Laplace transforms
(c) Z- transforms
(d) Partial differential equations

**DETAILED SYLLABUS**

**UNIT- I : FOURIER SERIES (7 periods)**

**Fourier series:** Determination of Fourier coefficients,convergence of Fourier series (Dirichlet'sconditions),Fourier series of even and odd functions, Half-range Fourier sine and cosine expansions.

**UNIT- II: FOURIER INTEGRALSAND FOURIER TRANSFORMS (8 periods)**

Fourier integral theorem (statement only), Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms –properties, Inverse transform and finite Fourier transforms.

**UNIT-III:LAPLACE TRANSFORMS (12 periods)**

Laplace transforms of standard functions. Properties of Laplace transforms. First and second shifting Theorems. Laplace transforms of derivatives and integrals. Inverse transforms. Convolution theorem (without proof), inverse Laplace transforms by convolution theorem. Laplace transform of periodic functions, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

**UNIT-IV : Z- TRANSFORMS (9 periods)**

Z – transforms, inverse Z– transforms, damping rule, shifting rule, initial and final value theorems. Convolution theorem(without proof), solution of difference equations by Z– transforms.

**UNIT – V : PARTIAL DIFFERENTIAL EQUATIONS (9 periods)**

Formation of Partial differential equations – Solutions of first order linear equations by method of grouping. First and second order equations by method of separation of variables – Solutions of one dimensional Wave equation, Heat equation.

**Total no. of periods: 45**

**TEXT BOOK:**


1. T.K.V. Iyengar, B. Krishna Gandhi,S.Ranganatham and M.V.S.S.N. Prasad,***Engineering Mathematics, vol-1***, S. Chand & Company 13/e,2014.
2. T.K.V. Iyenger, B. Krishna Gandhi, S.Ranganadham and M.V.S.S.N.Prasad, ***Mathematical Methods***,S.Chand and Company, 8/e,2013


**REFERENCE BOOKS:**


1. Grewal, B.S., ***Higher Engineering Mathematics***,Khanna publishers, Delhi, 42/e,2012

2. Kreyszig, E., ***Advanced Engineering Mathematics***,John Wiley and Sons, Inc.,9/e,2013.

**II B. Tech. – II Semester (ECE, EEE and EIE)/**

**III B. Tech. – I Semester (CSE, CSE (AI), CSE (DS), CSBS, CSSE, IT, CE and ME)**

## (19BT4BS01) MATERIAL SCIENCE

(Open Elective-1)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES: -**

**COURSE DESCRIPTION:** Introduction to Material Science and Engineering; Composite Materials; Smart Materials; Nano and Biomimetic Materials; Emerging Materials.

**COURSE OBJECTIVES:**

- To impart knowledge on processing, structure and properties of materials like composite materials, smart materials, biomimetric materials and nanomaterials.
- To develop awareness among the students about the impact of material science in engineering practices.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Attain the basic knowledge on composites, smart materials, biomimetic materials and nano materials.

**CO2.** Demonstrate essential information about structure and properties of various composites used in various engineering applications.

**CO3.** Understand the basic properties of electro-rheostatic, magneto-rheostatic and shape memory alloys used in device applications.

**CO4.** Accomplish the basic knowledge in nanomaterials to familiarize various nano structured device applications.

**CO5.** Outline the processing and properties of functionally graded materials and identify its applications in various fields.

**DETAILED SYLLABUS:**

**UNIT- I: INTRODUCTION TO MATERIAL SCIENCE AND ENGINEERING (08 Periods)**

Introduction - historical perspective - material science and engineering, classification of materials (metals, ceramics, polymers and composites) and advanced materials and their applications (biomaterials, smart materials and nanomaterials), modern materials needs. Processing, properties and applications of metals, polymers and ceramics (Qualitative).

**UNIT- II: COMPOSITE MATERIALS (10 Periods)**

Composite Materials - Classification, Laminated composites and Reinforced composite materials – Classification, structure and properties of sandwich composites – applications (commercial Aircraft, Marine Grade Sandwich, Automobile Grade Sandwich and Wind Turbine Blades), properties and applications of Nano composites - Advantages and Limitations of composites.

**UNIT- III: SMART MATERIALS (07 Periods)**

Classification of smart materials - Magneto-rheostatic (MR) and Electro-rheostatic (ER) materials - Shape Memory Alloys (SMA)- characteristics, Shape memory effect applications in different fields, advances in smart materials.

**UNIT – IV: NANO AND BIOMIMETIC MATERIALS (10 Periods)**

**Nanomaterials:** Introduction, Low dimensional structures and energy quantization. Fabrication of nano materials - Lithographic technique using photons, metallic, semiconducting and magnetic properties of nano materials and applications (renewable energy and nano electro-mechanical systems (NEMS)).

**Biomimetic materials** – Introduction- classification and their applications (Lotus effect, Dolphin sound wave technology and viper as a model in defence)

**UNIT- V: EMERGING MATERIALS (10 Periods)**

Functionally graded materials (FGM) - Types, processing, properties and potential applications, functionally graded fibre cement – structural material, Functionally Graded Nanoelectronic, Optoelectronic and Thermoelectric Materials (Qualitative) and its applications.

**Total Periods: 45**

**TEXT BOOKS:**

1. William D Callister, David G Rethwisch, *Materials Science and Engineering*, Wiley, 9th edition, 2014.

2. K M Gupta, *Engineering Materials – Research, Applications and Advances*, CRC press (Taylor & Francis group), 2015.

**REFERENCE BOOKS:**

1. Sulabha K Kulkarni*, Nanotechnology: Principles and practices*, Springer, 9th edition, 2014.

2. Charles P. Poole and Frank J. Owens, *Introduction to Nanotechnology*, Wiley-Interscience, May 2003.

3. Sulabha K Kulkarni, *Nanotechnology: Principles and Practices,* Springer, 3rd edition, 2014.

**II B. Tech. – II Semester (CSE, CSE (AI), CSE (DS), CSBS, CSSE, IT, CE and ME)/**
**III B. Tech. – I Semester (ECE, EEE and EIE)**

## (19BT4HS05) GENDER AND ENVIRONMENT

(Open Elective-2)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES: -**

**COURSE DESCRIPTION:** Gender and the environment relationship, Gendered Roles in the family & community, Gender and sustainable development, Gender in environmental justice, Gender &environmental security.

**COURSE OBJECTIVES:**

- To enhance understanding of environmental issues by considering the particular experiences of women and men in the face of environmental degradation and key areas in gender-environment relations and gender roles in thefamily, community and international levels.
- To trace how different feminisms, build on the core concepts of sustainability and justice to transform familiar debates in global environmental politics.
- To provide analysis of how gender relations affect the natural environment and how environmental issues have a differential impact on women and men.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1:** Apply the knowledge of gender & environment connections, key issues and topics within global environmental politics in environmental decision-making.

**CO2:** Comprehend the concepts of gender and sustainable development through debates, and policy documents.

**CO3:** Analyze the concept of environmental security and justice by identifying the sources of insecurity.

**DETAILED SYLLABUS**

**UNIT I: GENDER ANDENVIRONMENT RELATIONSHIP (9 Periods)**

Introduction–Gender and Environment–Development of gender roles–Society, gender & environment – Understanding environmental politics – Gender-environment connections–Eco-feminism - Cultural eco-feminism–Social eco-feminism - Feminist political ecology

**UNIT II: GENDERED ROLES IN THE FAMILY & COMMUNITY (9 Periods)**

Organization of the household – Domestic division of labour - Food: growing, harvesting, shopping, preparing, and cooking
Gender & Power- Planning – Politics – NGO – Gendering of environmental protest – Environmental decision-making

**UNIT III: GENDER ANDSUSTAINABLE DEVELOPMENT (9 Periods)**

Concept of sustainability & its achievement – Concept of sustainable development – Ecological Modernization – Gender & sustainability debates – Gender & sustainable development debates - Gender in policy documents – Gender, poverty & equity in sustainable development

**UNIT IV: GENDER IN ENVIRONMENTAL JUSTICE (9 Periods)**

Normative Concerns ( Fairness, Inequality & Justice) - Making sense of Environmental justice – Ecological debt, Transnational harm,& human rights – Ecological justice – Gender & Environmental Justice – Gender, Vulnerability & risk – Women in environmental justice movements – Knowledge & participation – Gender, sustainability& justice as guiding concepts

**UNITV: GENDER AND ENVIRONMENTAL SECURITY (9 Periods)**

Connections between security & the environment – **Gender, environment & security:**Sustainability as security - poverty & insecurity – Insecurity as injustice – Competing ways of thinking security – Reflecting on sources of insecurity – **Case Study** – Food Security -**Case Study** – The impacts of natural disasters

**Total Periods: 45**

**TEXT BOOKS:**

1. Nicole Detraz. (2017) "Gender and the Environment"Polity Press, Cambridge, UK.
2. Susan Buckingham- Hatfield. (2000) "Gender and Environment"Routledge, London.

**REFERENCE BOOKS:**


1. Promillakapur (ed). (2000). "Empowering Indian Women" Publication Division, Government of India, New Delhi.
2. Ronnie Vernooy, (Ed). (2006). "Social and gender Analysis Natural Resource Management: Learnning studies and lessons from Aisa" Sage, New Delhi.
3. Swarup, Hemlata and Rajput, Pam. (2000). Gender Dimensions of Environmental and Development Debate: The Indian Experience" In SturatS.Nagel, (ed). "India"s Development and Public Policy".Ashgate, Burlington.

**II B. Tech. – II Semester (CSE, CSE (AI), CSE (DS), CSBS, CSSE, IT, CE and ME)/**
**III B. Tech. – I Semester (ECE, EEE and EIE)**

## (19BT4HS09) LIFE SKILLS

(Open Elective-2)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES: -**

**COURSE DESCRIPTION:** Positive attitude; Self-discovery-Interpersonal relationships; Cross-cultural communication; Core thinking-Problem solving and Decision making; Business presentations and Public speaking.

**COURSE OBJECTIVES:**

- To inculcate skills for self-efficacy required to manage effective interpersonal relationships.
- To familiarize the strategies involved in problem solving, decision making and SWOT analysis.
- To develop presentation skills required in professional arena.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

**CO1.** Gain knowledge in strategies involved in developing positive attitude, process ofknowing oneself and managing effective interpersonal relationships.

**CO2.** Analyse problem solving strategies in Decision Making and SWOT analysis.

**CO3.** Communicate effectively with Engineering Community and Society by demonstrating presentation skills in professional arena.

**DETAILED SYLLABUS:**

**UNIT I: POSITIVE ATTITUDE (9 Periods)**

Introduction, Features of attitudes, Formation of attitudes, Ways of changing attitude in a person, Attitude in a work place, Developing positive attitude, Obstacles in developing positive attitude, Measuring attitude.

**UNIT II: SELF DISCOVERY AND INTERPERSONAL RELATIONSHIPS (9 Periods)**

Importance of knowing yourself, Process of knowing yourself, SWOT Analysis, Elements of attitude in interpersonal relationships, Methods to deal with different types of interpersonal relationship skills.

**UNIT III: CROSS-CULTURAL COMMUNICATION (9 Periods)**

Different Communication Styles, Cultural variables, communication sensitivity and variables of national culture, Individual Cultural Variables, Cross-cultural Communication Strategies, Potential hot spots in cross-cultural communication, Cross-cultural communication – Basic Tips.

**UNIT IV: CORE THINKING, PROBLEM SOLVING AND DECISION MAKING (9 Periods)**

Process of developing core thinking skills, Categories of thinking: Critical & Creative, Understanding problem solving, Cause of problems, Stages of problem solving, Methods of problem solving, Types of decision making.

**UNIT V: BUSINESS PRESENTATIONS AND PUBLIC SPEAKING (9 Periods)**

Business presentations and speeches, structuring the material, Types of delivery, Guidelines for delivery, Effective sales presentation, Controlling nervousness and stage fright.

**Total Periods: 45**

**TEXT BOOKS:**

1. Dr. K. Alex (2018) Soft Skills, S. Chand and Company Limited, New Delhi.

2. Manmohan Joshi (2017) Soft Skills, bookboon.com, Bangalore.

**REFERENCE BOOKS:**

1. Meenakshi Raman and Prakash Singh (2013), Oxford University Press, New Delhi.

2. Jeff Butterfield (2011) Soft Skills for Everyone, Cengage Learning India Private Limited, Delhi.

**II B. Tech. – II Semester (CSE, CSE (AI), CSE (DS), CSBS, CSSE, IT, CE and ME)/**

**III B. Tech. – I Semester (ECE, EEE and EIE)**

**(19BT4HS11) PROFESSIONAL ETHICS**

(Open Elective -2)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES: -**

**COURSE DESCRIPTION:** Engineering Ethics; Professional Ideals and Virtues; Engineering as Social Experimentation; Responsibilities and Rights; Global Issues.

**COURSE OBJECTIVES:**

- To impart fundamental concepts of engineering ethics, professional values and social responsibility.
- To develop skills in discharging the professional responsibilities as managers, advisors and leaders
- To apply code of ethics in workplace.

**COURSE OUTCOMES:** After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge in Engineering Ethics, Responsibilities and Rights.

CO2. Analyze the concepts of Engineering in Social Experimentation and Global Issues.

CO3**.** Apply the nuances of professional ideals at work place and in social context.

**DETAILED SYLLABUS:**

**UNIT - I: ENGINEERING ETHICS (9 periods)**

Scope and aim of engineering ethics, Senses of engineering ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus and controversy.

**UNIT - II: PROFESSIONAL IDEALS AND VIRTUES (8 periods)**

Theories about virtues, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest,

Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

**UNIT - III: ENGINEERING AS SOCIAL EXPERIMENTATION (10 periods)**

Engineering as experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, Engineers as responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards, Problems with the law of engineering.

**UNIT - IV: RESPONSIBILITIES AND RIGHTS (9 periods)**

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights and discrimination.

**UNIT - V: GLOBAL ISSUES (9 periods)**

Multinational corporations, Professional ethics, Environmental ethics, Computer ethics, Engineers as consultants, Witnesses, Advisors and Leaders, Engineers as Managers, Managerial ethics applied to Engineering Profession, moral leadership.

**Total Periods: 45**

**TEXT BOOKS:**


1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd edition, 2007.
2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.


**REFERENCE BOOKS:**


1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.

**II B.Tech.- II Semester(ECE, EEE and EIE)/**
**III B.Tech.- I Semester (CSE, CSE (AI), CSE (DS), CSBS, CSSE, IT, CE and ME)**

## (19BT4HS12) WOMEN EMPOWERMENT (Open Elective-1)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES:**

**COURSE DESCRIPTION:** Concept & Framework, Status of Women, Women's Right to work, International Women's Decade, and Women Entrepreneurship.

**COURSE OBJECTIVES:**

- To provide knowledge on the concept and framework for women empowerment, socio-economic political status of the women and develop consciousness among themselves to fight for their rights,
- To witness unprecedented efforts from various sectors to reassess the roles of women, to enlarge the information base, to search for alternative strategies for women's equality and development and to develop policies and programs addressed to women's specific problems and needs.
- To create awareness on women entrepreneurship and schemes for the development of women entrepreneurship and entrepreneurial challenges and opportunities

**COURSE OUTCOMES:** After successful completion of the course, the students will be able to:

**CO1:** Demonstrate the characteristics of empowered women, their achievements, and frame work for women empowerment, legal laws, and political status of women.

**CO2:** Apply the knowledge of women rights to address various societal issues and obstacles in different fields including science and technology.

**CO3:** Understand the significance of participation in policy debates, National conferences and common forums for women's' equality and development.

**CO4:** Analyze the concept of women entrepreneurship, government schemes and entrepreneurial challenges and opportunities.

**DETAILED SYLLABUS:**

**UNIT I: CONCEPT & FRAMEWORK (9 Periods)**

Introduction- Empowered Women's Characteristics- Achievements of Women's Empowerment **Concept of Empowerment:** Meaning& Concept- Generalizations about Empowerment -Empowerment Propositions - Choices women can make for empowerment - Women's participation in decision making, development process & in Governance. **Framework for Women's Empowerment** - Five levels of equality- Tenets of Empowerment- Elements - Phases and aspects - Techniques - Categories and Models – Approaches.

**UNIT II: STATUS OF WOMEN (9 Periods)**

**Legal Status:** Present Scenario- Call for Social change- Significant trends - Legal & Schemes - Personal Law- Joint Family- Criminal Law- Shift towards Dowry - Deterrent Punishment - Criminal Law(II Amendment) - Discrimination in Employment

**Political Status:** Present Scenario - Political Participation & its Nature- Socio-economic Characteristics - Political Mobilization: Mass Media - Campaign Exposure - Group Orientation - Awareness of issues and participation - Progress & Future Thrust.

**UNIT III: WOMEN'S RIGHT TO WORK (9 Periods)**

Introduction- Present Scenario - Changes in Policy &Programme - National Plan of Action- Women's Cells and Bureau - Increase in work participation rate- Discrimination in labourmarket - Women in unorganized sector - Issues and Obstacles- Women in Education - Women in Science & Technology –

**Case Study:** Linking Education to Women's Access to resources.

**UNIT IV: WOMEN'S PARTICIPATORY DEVELOPMENT (9 Periods)**

Dynamics of social change- conscious participation - Information Explosion - Organized Articulation - National Conference - Common Forums - Participatory Development - New Issues Identified - Role of other Institutions.

**UNIT V: WOMEN ENTREPRENEURSHIP (9 Periods)**

Introduction–Definition-Concept- Traits of women Entrepreneurs- Role of women Entrepreneurs in India -Reasons of Women Entrepreneurship- Government schemes & Financial Institutions to develop Women Entrepreneurs - Key policy recommendations - Project Planning-Suggestions and measures to strengthen women entrepreneurship - Growth & Future challenges - Training and Opportunities –

**Case Study:** Training Women as Hand-pump Mechanics

**Case Study** : Literacy for Empowering Craftswomen

**Total Periods: 45**

**TEXT BOOKS:**


1. NayakSarojini, Nair Jeevan(2017), "Women's Empowerment in India". Pointer Publishers, Jaipur
2. SahaySushama (2013), "Women and Empowerment" Discovery Publishing House, New Delhi.

## II B. Tech. - II Semester

## (19BT40107) SUSTAINABLE ENGINEERING

(Open Elective-2)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES:** --

**COURSE DESCRIPTION:** Principles of sustainability; Sustainability metrics and assessment tools; Sustainable engineering practices; Sustainable engineering applications; Sustainable urbanization and industrialization.

**COURSE OUTCOMES:** *After successful completion of the course, students will be able to:*

CO1. Analyze the principles of sustainability to solve complex environmental problems following relevant standards/protocols considering society, health, safety and environment.

CO2. Analyze sustainability metrics and assessment tools to solve complex environmental problems following relevant standards and emerging trends considering society, health, safety, environment and economics besides communicating effectively in graphical form.

CO3. Analyze sustainable engineering practices to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO4. Design sustainable engineering applications to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

CO5. Analyze sustainable urbanization and industrialization principles to solve complex environmental problems using appropriate tools and techniques following relevant standards considering society, health, safety, environment, economics and management besides communicating effectively in graphical form.

**DETAILED SYLLABUS:**

**UNIT I–PRINCIPLES OF SUSTAINABILITY (9 periods)**

Emerging challenges, Sustainability and sustainable engineering; Environmental concerns; Social, economic and legal issues; Availability and depletion of natural resources, Disaster resiliency; Multilateral environmental agreements – Basel convention, Clean development mechanism (CDM), Montreal and Kyoto protocols.

**UNIT II–SUSTAINABILITY METRICS AND ASSESSMENT TOOLS (9 periods)**

Sustainability indicators, metrics and assessment tools, Material flow analysis and material budget, Carbon footprint analysis, Life cycle assessment, Streamlined life-cycle

assessment (SLCA), Economic input output-life cycle analysis, Environmental health risk assessment, Other emerging assessment tools.

**UNIT III–SUSTAINABLE ENGINEERING PRACTICES (9 periods)**

Sustainable energy engineering, Sustainable waste management, Green and sustainable buildings and infrastructure, Sustainable civil infrastructure, Sustainable remediation of contaminated sites, Climate geoengineering.

**UNIT IV–SUSTAINABLE ENGINEERING APPLICATIONS (9 periods)**

Environmental and chemical engineering projects, Materials engineering projects, Infrastructure engineering projects – Background, Methodology, Goal and Scope, Study area, Technical design, Environmental sustainability, Life cycle assessment, Economic sustainability, Social sustainability, Rating systems – ENVISION, LEED, GRIHA, IGBC; Conclusions.

**UNIT V–SUSTAINABLE URBANIZATION AND INDUSTRIALIZATION (9 periods)**

Sustainable urbanization and industrialization, United Nations sustainable development goals – Right to education, Poverty eradication, Social and technological changes; Industrial Processes - Material selection, Energy efficiency, Pollution prevention and control techniques, Industrial Ecology, Industrial symbiosis.

**Total Periods: 45**

***Topics for self-study are provided in the lesson plan***

**TEXT BOOKS:**


1. Reddy, K.R., Cameselle, C., and Adams, J.A., *Sustainable Engineering: Drivers, Metrics, Tools, and Applications*, John Wiley &Sons, Inc., Hoboken, New Jersey, 2019, 544p (ISBN: 978-1-119-49393-8).
2. Allen, D. T. and Shonnard, D. R., *Sustainability Engineering: Concepts, Design and Case Studies*, Pearson Education, 1st Edition, 2012.


**REFERENCE BOOKS:**


1. Bradley. A.S; Adebayo,A.O., Maria, P.,*EngineeringApplications in Sustainable Design and Developmen*t, Cengage Learning, 1st Edition, 2016.
2. Purohit, S. S., *Green Technology: An Approach for Sustainable Environment*, Agrobios Publication, 1st Edition, 2016.
3. *Energy Conservation Building Code (ECBC) 2007*, Bureau of Energy Efficiency, Govt. of India, New Delhi.
4. Twidell, J. W. and Weir, A. D., *Renewable Energy Resources*, Routledge, Taylor & Francis Group, 3rd Edition, 2015.


**ADDITIONAL LEARNING RESOURCES:**


1. Daniel A. Vallero and Chris Brasier, *Sustainable Design: The Science of Sustainability and Green Engineering*, Wiley-Blackwell, 1st Edition, 2008.
2. Jorge A. Vanegas, *Sustainable Engineering Practice: An Introduction*, Committee on Sustainability, American Society of Civil Engineers, https://doi.org/10.1061/9780784407509, 2004.

3. Mackenthun, K.M., *Basic Concepts in Environmental Management*, CRC Press, Taylor & Francis Group, 1st Edition, 1999.
4. *Environment Impact Assessment Guidelines*, Notification of Government of India, 2006.

## I B.Tech. – I Semester

## (19BT10341) BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to EEE, ECE and EIE)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES:**--

**COURSE DESCRIPTION:** Overview of Civil Engineering; Surveying, Civil Engineering Materials, Mechanics of Materials, Building Components, Civil Engineering Infrastructure; Overview of Basic Mechanical Engineering; Internal Combustion Engines and Turbines, Mechanical Power Transmission Systems, Manufacturing Processes, Machining Processes, Non-Conventional Machining.

**COURSE OUTCOMES:**

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

CO1. Apply the basic principles of civil engineering, Techniques and tools for analyzing civil structures and solve related problems.

CO2. Describe the working of principles of basic mechanical engineering and solve problems related to it.

**DETAILED SYLLABUS:**

**Part – A: CIVIL ENGINEERING**

**UNIT –I: SURVEYING AND CIVIL ENGINEERING MATERIALS (10 Periods)**

**Overview of Civil Engineering:** Civil Engineering contributions to the welfare of society, specialized sub disciplines in Civil Engineering.

**Surveying:** Objectives, classification and principles; Measurements – distances, angles, levels, areas and volumes; contouring; Illustrative examples.

**Civil Engineering Materials:**Bricks, stones, concrete, steel, glass, timber, composite materials.

**Mechanics of Materials:** Forces, system of forces, laws of mechanics ,moment of a force, equilibrium, resultant, Internal and External forces, Stress, Strain, Hooke's law and Elasticity.

**UNIT–II: BUILDING COMPONENTS AND CIVIL ENGINEERING INFRASTRUCTURE (8 Periods)**

**BUILDING COMPONENTS:**

**Sub structure -** Types of foundations, Bearing capacity and settlement, Requirement of good foundations.

**Superstructure -** Civil engineering construction - Brick masonry, Stone masonry, Beams, Columns, Lintels, Roofs, Floors, Stairs, Building bye-laws - bye-laws floor area, carpet area and floor space index, basics of interior design and landscaping.

**Civil Engineering Infrastructure** - Types of Bridges and Dams, Water supply and Sanitary systems, Rainwater harvesting, Types of Highways and Railways, Ports and Harbours.

**Part – B: MECHANICAL ENGINEERING**

**UNIT –III: INTERNAL COMBUSTION ENGINES, TURBINES AND PUMPS (9 Periods)**

**Overview of Mechanical Engineering:** Introduction to Mechanical Engineering**,** specialized sub disciplines in Mechanical Engineering.

**Internal Combustion Engines** - Classification – Working principle of Petrol and Diesel Engines – Four stroke and two stroke engines – Comparison of four stroke and two stroke engines.

**Turbines and Pumps** – Classifications of Steam turbines - Impulse turbine, Reaction turbines; Working principle of Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.

**UNIT –IV: MECHANICAL POWER TRANSMISSION SYSTEMS (9 Periods)**

**Power Transmission Systems**: Belt, rope and chain drives, Gears and Transmission screw

**Power transmission by belts**: Classification of belts, Length of the Belt (Open and Crossed-Belt Drives), Power Transmitted by Belt Drive, Tension due to Centrifugal Forces, Initial Tension, Maximum Power Transmitted.

**Power transmission by Gear train:** Gear terminology, Classification of gears, Gear train- Simple Gear Train and Compound Gear Train, Power Transmitted by Simple Gear Train.

**UNIT –V: MANUFACTURING PROCESSES (9 Periods)**

**Manufacturing processes:** Elementary ideas of Casting, Forging, Rolling, Welding, Soldering and Brazing.

**Machining processes**- Lathe-Turning, Taper turning, Thread cutting, Shaping, Drilling, Grinding, Milling (simple sketches and short notes).

**Total Periods: 45**

***Topics for Self Study are provided in the Lesson Plan***

**TEXTBOOKS:**


1. Shanmugam G. and Palanichamy M.S., *Basic Civil and Mechanical Engineering*, Tata McGraw Hill PublishingCo.,NewDelhi, 1st edition 2018.
2. R. Vaishnavi, M. Prabhakaran& V. Vijayan, *Basic Civil and Mechanical Engineering*, S.CHAND Publications, 2nd edition, 2013.

3. B.C Punmia, Ashok Kumar Jain, Arunkumar Jain, *Surveying (vol-I),* Laxmi publications, 16th edition, 2005.
4. B. C Punmia, Ashok Kumar Jain, Arunkumar Jain, *Building Construction,* Laxmi publications, 10th edition, 2008.

**REFERENCES:**

1. Seetharaman S., *Basic Civil Engineering*, Anuradha Agencies, 2005.
2. Ramamrutham S., *Basic Civil Engineering*, DhanpatRai Publishing Co.(P) Ltd.1999.
3. Kalpakjian, Serope, *Manufacturing Engineering and Technology,* Pearson Education, 7th edition, 2014.
4. Prabhu.T.J, Jai Ganesh. V and Jebaraj.S, *Basic Mechanical Engineering*, Scitech Publications, Chennai, 2000.
5. Pravin Kumar, *Basic mechanical engineering* Pearson Education, 1st edition, 2013.

## I B. Tech. – II Semester

## (19BT10501) PROGRAMMING FOR PROBLEM SOLVING

(Common to EEE, ECE, EIE and CSBS)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | 1 | - | 4 |

**PRE-REQUISITES:** A course on Basic Mathematics

**COURSE DESCRIPTION:** Introduction to problem solving approach, Introduction to Python programming, control structures, sequences, sets, Dictionaries, Implementation of Data structures using Python, Modular programming, file handling, Data representation and Visualization.

**COURSE OUTCOMES:**

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

CO1. Demonstrate knowledge on Python constructs to solve basic problems.

CO2. Demonstrate knowledge on Python constructs to solve basic problems.

**DETAILED SYLLABUS:**

**UNIT-I: INTRODUCTION TO PROBLEM SOLVING AND PYTHON PROGRAMMING (10 Periods)**

**Problem Solving Aspect**: top-down design, implementation of algorithms, building blocks of flow charts, program verification and efficiency of algorithms.

**Python Programming:** tokens, literals, identifiers, keywords, special symbols and operators; fundamental data types, expressions, type conversions, handling Input and output in Python.

**UNIT-II: CONTROL STRUCTURES (8 Periods)**

**Selection Statements**: if statement, if-else statement, if-elif-else statement, nested-if statement.

**Iterative Statements**: while loop, for loop, break statement, continue statement, pass and else statements used with loops.

**UNIT-III: SEQUENCES, SETS, DICTIONARIES AND DATA STRUCTURES (9 Periods)**

**Sequences: Lists and operations -** creating, inserting elements, updating elements, deleting elements, searching and sorting, list comprehensions, nested lists; **tuples -** creating, searching and sorting, nested tuples; **strings -** Initializing a string and string operations, string handling methods, string formatting; **sets -** set creation and

operations; **dictionaries -** operations on dictionaries, dictionary methods, sorting elements using lambdas.

**Data structures: Stacks -** push, pop, peek and display operations on stack, applications of stack; **Queues –** enqueue, dequeue and display operations on queue, applications of queues.

**UNIT-IV: MODULAR PROGRAMMING AND FILE HANDLING (10 Periods)**

**Modular Programming**: need for functions, function definition, function call, variable scope and lifetime, return statement, positional arguments, keyword arguments, default arguments and variable-length arguments, recursive functions; Modules - math, NumPy, date and time.

**File Handling:** types of files, opening and closing files, reading and writing data.

**UNIT-V: DATA REPRESENTATION AND VISUALIZATION (8 Periods)**

Pandas: creating data frame, reading data from CSV files, indexing and selecting data, dealing with rows and columns; Visualization - bar plots, histogram, Scatter Plot.

**Total Periods: 45**

***Topics for Self Study are provided in the Lesson Plan***

**TEXT BOOKS**:


1. R. NageswaraRao, *Core Python Programming,* 2nd edition, Dreamtech Press, 2018.
2. R. G. Dromey, *How to solve i*t by Computer,* Pearson, 2006.


**REFERENCE BOOKS**:


1. ReemaThareja, *Python Programming using Problem Solving Approach*, 1st edition, Oxford University Press, 2017.
2. Charles Dierbach, *Introduction to Computer Science using Python: A Computational Problem-Solving Focus*, Wiley India, 2016.

## I B. Tech. – II Semester

## (19BT10531) PROGRAMMING FOR PROBLEM SOLVING LAB

(Common to EEE, ECE, EIE and CSBS)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 50 | 50 | 100 | - | - | 2 | 1 |

**PRE-REQUISITES:** A course on Basic Mathematics

**COURSE DESCRIPTION:** The course is designed to provide hands on practice on Scratch programming and python programming for problem solving.

**COURSE OUTCOMES:**

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

CO1. Develop scripts using Scratch tool to simulate simple problems.

CO2. Apply Python Constructs and Modules to develop solutions for real-life problems.

CO3. Function effectively as an individual and in team to foster knowledge and creativity.

CO4. Write and present a substantial technical report/ document effectively.

**PRACTICAL EXERCISES:**

1) a) Design a script in Scratch to simulate Airplane for take-off and land.

   b) Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.

2) a) Design a script in Scratch to calculate factorial of a given number.

   b) Design a script in Scratch to simulate Maze game. (Hint: To get Maze images refer http://inventwithScratch.com/downloads/)

3) a) Write a python script to read two integer numbers and perform arithmetic operations.

   b) Write a python script to evaluate following expressions by considering necessary inputs.

   i) $ax^2 + bx + c$ ii) $ax^5 + bx^3 + c$ iii) $(ax + b) / (ax - b)$ iv) $x - a / b + c$

4) a) Write a python script to convert given decimal number into octal, hexa decimal and binary.

   b) Write a python script to read four integer values separated with commas and display the sum of those four numbers.

   c) Write a python script to print "SVEC" with prefix of ten spaces by using format().

5) a) Write a python script to calculate electricity bill based on following slab rates.

| **Consumption units** | **Rate (in Rupees/Unit)** |
|---|---|
| 0-100 | 4 |
| 101-150 | 4.6 |
| 151-200 | 5.2 |

| | | | |
|---|---|---|---|
| | 201-300 | 6.3 |
| | Above 300 | 8 |

(Hint: To get Consumption units take current Meter reading, old meter reading from the user as input)

b) Print the following pattern using python script.

```
        1
      1 2 1
    1 2 3 2 1
  1 2 3 4 3 2 1
1 2 3 4 5 4 3 2 1
```

6) a) Write a python script to read *N* student details like name, roll number, branch and age. Sort the student details based on their names and display.

b) Write a python script to delete duplicate strings from a list of strings. (Insertion order should maintain after deleting duplicate string).

c) Write a python script to read N number of student details into nested list and convert that as a nested dictionary.

7) a) Design a function that can perform sum of two or three or four numbers.

b) Write a python script to implement towers of Hanoi problem.

c) Write a Python function prime square (l) that takes a nonempty list of integers and returns True if the elements of l alternate between perfect squares and prime numbers, and returns False otherwise. Note that the alternating sequence of squares and primes may begin with a square or with a prime. Here are some examples to show how your function should work.

```
>>>primesquare([4])
True
>>>primesquare([4,5,16,101,64])
True
>>>primesquare([5,16,101,36,27])
False
```

8) a) Write a python script to perform arithmetic operations on numpyarrays.

b) Write a python script to perform following matrix operations using numpy.

i) Dot product ii) Matrix product iii) Determinant iv) Inverse

9) a) Write a python script to Create Pandas data frame using list of lists.

b) Write a python script to load data from a CSV file into a Pandas Data Frame and perform basic operations on it.

10) a) Draw a Scatter Plot by considering an appropriate data set.

b) Draw histograms by considering an appropriate data set.

11) **Mini Project-1**

12) **Mini Project-2**

**TEXT BOOK**:

1. R. NageswaraRao, *Core Python Programming*, 2nd edition, Dreamtech Press, 2018.

## II B. Tech. - II Semester

## (19BT50409) GREEN TECHNOLOGIES

(Open Elective-2)

(Common to CE, ME, CSE, CSSE, IT, CSE (AI), CSE (DS) and CSBS)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 40 | 60 | 100 | 3 | - | - | 3 |

**PRE-REQUISITES: --**

**COURSE DESCRIPTION:** Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing.

**COURSE OUTCOMES:** *After successful completion of the course, students will be able to:*

CO1. Analyze energy efficient communication systems such as Telecommunication systems, ICT, Wireless networks and cellular networks by understanding the principles of green communications.

CO2. Understand the impact of conventional energy sources on environment and realize the significance and principles of green energy sources for sustainability.

CO3. Understand the environmental impacts of IT and approaches for Green IT.

CO4. Analyze concepts of sustainable green construction using appropriate tools and techniques following latest developments and considering safety and environment besides communicating effectively in graphical form.

CO5. Demonstrate the environmental impact of traditional manufacturing and explore the need for green manufacturing process promoting sustainability.

**DETAILED SYLLABUS:**

**UNIT I–PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS**

**(9 periods)**

**Principles of Green Engineering:** Introduction, Definition of green engineering, Principles of green engineering

**Green Communications:** Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green wireless networks, Embodied energy of communication devices- Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

**UNIT II–GREEN ENERGY (9 periods)**

Introduction, green energy systems - composition, adverse impacts,Green energy and sustainability, the target and solution.Diversification and localization of energy systems,

green energy and sustainable development.Energy sources and their availability. Green energy sources - solar energy, wind energy, geothermal energy, ocean energy, biomass and biogas.

**UNIT III–GREEN IT (9 periods)**

Introduction, Awareness to Implementation: Green IT Trends, Green Engineering, Greening by IT: Using RFID for Environmental Sustainability, Smart Grids, Smart Buildings and Homes, Green Supply Chain and Logistics, Enterprise-Wide Environmental Sustainability, A Seven-Step Approach to Creating Green IT Strategy: Balancing the Costs and Benefits of Going Green, Research and Development Directions.

**UNIT IV–GREEN CONSTRUCTION (9 periods)**

**Green Building:** Concept, Necessity, Characteristics, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures, case studies of residential and commercial green buildings.

**Vastu:** Concept, History, scientific approach, elements of vastu for selecting a plot.

**Indian Green Building Council:** Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

**UNIT V – GREEN MANUFACTURING (9 periods)**

Green Manufacturing - Introduction, Background and Definition; Impact of traditional manufacturing in environmental ecology, Need for green manufacturing, Motivation and barriers to green manufacturing, Advantages and Limitations of green manufacturing, Green manufacturing strategies,Green manufacturing and sustainability, Green manufacturing through clean energy supply, Green packaging and Supply chain.

**Total Periods: 45**

***Topics for self-study are provided in the lesson plan***

**TEXT BOOKS:**


1. KonstantinosSamdanis, Peter Rost, Andreas Maeder, MichelaMeo, Christos Verikoukis, *Green Communications: Principles, Concepts and Practice*, John Wiley & Sons, 2015.
2. G.D. Rai, *Non-conventional Energy Sources*, KhannaPublishers, Delhi, 5th Edition,2011.
3. San Murugesan, G.R. Gangadharan, *Harnessing Green IT – Principles and Practices*, John Wiley & Sons Ltd., 2008.
4. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison, *Green Building Handbook*, Volume 1, E & FN Spon, an imprint of Thomson Science & Professional.
5. J Paulo Davim, *Green Manufacturing: Processes and Systems*, Springer, 2012.

6. David A Dornfeld, *Green Manufacturing: Fundamentals and Applications*, Springer, 2013.

**REFERENCE BOOKS:**

1. Soli J. Arceivala, *Green Technologies for a better future,* McGraw Hill Education (India) Pvt. Ltd, 2014.
2. Marty Poniatowski, *Foundation of Green Information Technology, Prentice Hall, 2009.*
3. Athanasios V Alavanidis, ThomaisVlachogianni, *Green Chemistry and Green Engineering*, SynchronaThemata, 2012.

IV B.Tech. - I Semester

# (16BT70412)GREEN TECHNOLOGIES

(Open Elective)

(Common to EEE, ECE & EIE)

| Int. Marks | Ext. Marks | Total Marks | L | T | P | C |
|---|---|---|---|---|---|---|
| 30 | 70 | 100 | 3 | 1 | - | 3 |

**PREREQUISITES:** --

**COURSE DESCRIPTION:**

Principles of green engineering; Green communications; Green energy; Green computing; Green construction; Green manufacturing.

**COURSE OUTCOMES:** On successful completion of the course, students will be able to

CO1. Deploy conceptual knowledge in green technologies pertaining toengineering practice.
CO2. Analyze various green technologies for engineering practice.
CO3. Provide green solutions to engineering problems.
CO4. Apply various green techniques in the engineering practice.
CO5. Consider health and safety issues while providing green solutions to the society.
CO6. Understand issues related to environment sustainability.
CO7. Apply ethical standards for environmental sustainability in the engineering practice.

**DETAILED SYLLABUS:**

**UNIT-I: PRINCIPLES OF GREEN ENGINEERING AND GREEN COMMUNICATIONS (11 Periods)**

**Principles of Green Engineering:**

Introduction, Definition of green engineering, Principles of green engineering.

**Green Communications:**

Introduction, Origin of Green Communications, Energy Efficiency in Telecommunication systems, Telecommunication system model and energy Efficiency, Energy saving concepts, Quantifying energy efficiency in ICT, Energy efficiency metrics of green wireless networks, Embodied energy of communication devices- Introduction, The extended energy model, Embodied/Operating Energy of a BS in Cellular network- A Case study; Energy efficient standards for wireline communications.

**UNIT-II: GREEN ENERGY (09 Periods)**

Introduction, adverse impacts of carbon emission, control of carbon emission– methods, greenhouse gas reduction – methods, Energy sources and their availability, Green energy for sustainable development. Green energy sources – Solar energy, Wind energy, Fuel cells, Biofuels, Wave and Geothermal energy (Principle of generation only).

**UNIT-III: GREEN IT (09 Periods)**

The importance of Green Information technologies, Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social Media,

Regulating Green IT- Laws, Standards and Protocols; RoHS, REACh, WEEE, Legislating for GHG Emissions and Energy Use of IT Equipment, Non-regulatory Government Initiatives, Industry Associations and Standard Bodies, Green Building Standards, Green Data Centres, Social Movements and Greenpeace, Conclusions.

**UNIT-IV: GREEN CONSTRUCTION (09 Periods)**

**Green Building:** Definition, Typical features, Benefits, Requisites for green building construction, Sustainability, Concept of REDUCE, REUSE, RECYCLE, RETHINK, REPLENISH AND REFUSE (6 R's), Sustainable construction focus point – Site selection, Planning, Water, Energy, Material, Indoor air quality, Construction procedures.

**Indian Green Building Council:** Introduction to IGBC green homes, Benefits of IGBC, IGBC green home rating system, Introduction to USGBC, LEED rating system, Procedure to get IGBC certification, GRIHA Rating.

**UNIT-V: GREEN MANUFACTURING (09 Periods)**

Introduction, background, definition, motivation and barriers to green manufacturing, Impact of manufacturing in environmental ecology, Need for green manufacturing, Advantages and Limitations, green manufacturing strategies, Green manufacturing and sustainability, Sustainability tools; Waste stream mapping and application, Green manufacturing through clean energy supply, green lean manufacturing, green packaging and supply chain.

**Total Periods: 47**

**TEXT BOOKS:**


1. KonstantinosSamdanis, Peter Rost, Andreas Maeder, MichelaMeo, Christos Verikoukis, *Green Communications: Principles, Concepts and Practice,*John Wiley & Sons, 2015.
2. Soli J. Arceivala, *Green Technologies for a better future,* McGraw Hill Education (India) Pvt. Ltd, 2014.
3. San Murugesan, G.R. Gangadharan, *Harnessing Green IT – Principles and Practices,* John Wiley & Sons Ltd., 2008.
4. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison, *Green Building Handbook*, *Volume 1*, E & FN Spon, an imprint of Thomson Science & Professional.
5. *IGBC Green Homes Rating System Version 1.0* – A bridged reference guide.
6. J Paulo Davim, Green Manufacturing: Processes and Systems, Springer, 2012.
7. David A Dornfeld, Green Manufacturing: Fundamentals and Applications, Springer, 2013.


**REFERENCE BOOKS:**


1. Athanasios V Alavanidis, ThomaisVlachogianni, *Green Chemistry and Green Engineering*, SynchronaThemata, 2012.
2. G.D. Rai, *Non-conventional Energy Sources*, Khanna Publishers, Delhi, 5$^{th}$Edition,2011.
3. Marty Poniatowski, *Foundation of Green Information Technology, Prentice Hall, 2009.*
4. R. K. Gautham, *Green Homes*, BS publications, 2009.