

**TRIPURA UNIVERSITY
(A CENTRAL UNIVERSITY)**

CURRICULUM STRUCTURE

OF

4 YEARS

BACHELOR OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL

ENGINEERING(EE)

3rd Semester

2021

3rd SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/ week	Credit	Full Marks
1.	Humanities Science - 2	HS 301	Effective Technical Communication	3	0	0	3	3	100
2.	Basic Science - 7	BS 302	Mathematics-III	2	1	0	3	3	100
3.	Basic Science - 8	BS 303	Biology for Engineers	2	0	0	2	2	100
4.	Engineering Science - 5	ES 304	Engineering Mechanics	2	1	0	3	3	100
5.	Program Core - 1	PC EE 305	Electrical Circuits Analysis	3	1	0	4	4	100
6.	Program Core - 2	PC EE 306	Analog Electronics	3	1	0	4	4	100
7.	Program Core - 3	PC EE 307	Electrical Estimation & Design Practices	0	0	2	2	1	100
8.	Program Core - 4	PC EE 308	Electrical Circuits Laboratory	0	0	2	2	1	100
9.	Program Core - 5	PC EE 309	Analog Electronics Laboratory	0	0	2	2	1	100
10.	Mandatory Course - 3	MC 310	Indian Constitution	2	0	0	2	0	100
Total :				17	4	6	27	22	1000

EFFECTIVE TECHNICAL COMMUNICATION

Course Code	HS 301
Course Title	Effective Technical Communication
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	1st year B.Tech
Course Category	Humanities Science (HS)
Number of classes	36 hours

Course Outcomes:

At the end of the course, the student will be able to –

CO Number	CO Description	K-level
CO-1	Understand the nature and objective of Technical Communication relevant for the work place as Engineers	K2
CO-2	Utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.	K3
CO-3	Develop effective verbal and non-verbal communication skills.	K3
CO-4	Analyze ethical, legal, cultural, and global issues affecting Technical Communication and Develop appropriate life skills.	K4

Module 1: Essentials of Communication (09 hrs):

What is Communication, Process of Communication, Levels of communication, The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group) Communication Barriers to communication, Non-verbal Communication, , Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance of Technical Communication, Differences between general and technical communication.

Module 2: Technical Writing Skills (09 hrs):

Technical writing process – Choosing right words, phrases and sentence patterns, clarity of purpose, planning content, effective style of writing, formatting, proofreading. Technical Reports & Proposals: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Writing of Reports & Proposals. Business letters: Sales & Credit letters; Claim and Adjustment Letters; Letters of Enquiry, Order Placement letters Email Writing: Reasons for popularity; guiding principles for composition; some common pitfalls; maintaining common etiquette.

Module: 3 Workplace Communication (09 hrs):

Applying for a job: Skimming advertisements; Writing job applications; Preparing CV, Resume. Group Discussions: Group Discussion types; GD as a part of selection process; Key skills to succeed in group discussions; Dos and Don'ts of group discussions; Use of body language in GDs. Job Interviews: Objectives; Types; Stages of Interview, Face to face Interviews; Telephonic Interviews. Effective Business Presentations: Importance in workplace communication; Planning, Preparing, Organizing, Rehearsing, and Delivering Oral presentations, Handling Questions; Visual aids in presentations; Power Point Presentations Ethics in Communication: Communication challenges in culturally diverse workforce; Bias-free communication

Module: 4 Developing soft skills/ Life Skills (09 hrs):

Introduction to soft skills: Soft skills as a competitive weapon in today are changing workplace. Classification of soft skills: Time management, Attitude, Responsibility, Ethics & Values, self-confidence, Teamwork and Interpersonal skills, Problem solving skills. Personality Development: Developing Right personality to enhance Life Skills, Personality types; Personality attributes; and Leadership Qualities. Body Language : Emotions displayed by body language: Aggressive, Submissive, Attentive, Nervous, Upset, Bored, Relaxed, Defensive; Hand Shake; Eye Contact; Posture and Positioning. Personality traits and soft skills in early stages of career advancement and for future career advancement.

List of Software/Learning Websites

1. <http://www.free-english-study.com/>
2. <http://www.english-online.org.uk/course.htm>
3. <http://www.english-online.org.uk/>
4. <http://www.talkenglish.com/>
5. <http://www.learnenglish.de/>

Recommended Books:

- 1) Sanjay Kumar & Pushp Lata Communications Skills , 2nd Edition, Oxford University Press
- 2) Meenakshi Raman & Sangeeta Sharma Technical Communication: Principles & Practice Oxford University Press
- 3) Barun Kumar Mitra, Personality Development and Soft Skills Oxford University Press.
- 4) Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi.
- 5) Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
- 6) Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.

- 7) Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, McGraw Hill & Co. Ltd., 2001, New Delhi.
- 8) A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
- 9) Skills for Effective Business Communication by Michael Murphy, Harward University, U.S

MATHEMATICS-III

Course Code	BS 302
Course Title	Mathematics-III
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	B.Tech 1 st Year Mathematics
Course Category	Basic Science (BS)
Number of classes	36 hours

Course Outcome:-

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

CO No	CO Description	K-level
CO-1	Solve problems in 1 st and 2 nd order linear Partial Differential Equations	K3
CO-2	Show fourier series expansion of a given function and solve PDEs by variables separable method	K3
CO-3	Identify mean and variance of a given probability distribution	K3
CO-4	Solve numerically algebraic/transcendental equation and ordinary differential equations	K3

Course Content:-

Module 1: Partial Differential Equations (10 hrs)

First order partial differential equations, solutions of first order linear and quasi-linear partial differential equation ($Pp + Qq=R$) by Lagrange method. Homogeneous and non-homogeneous type of second order linear differential equation with constant coefficients by complimentary function and particular integral method.

Module 2: Fourier series (08 hrs)

Expansion of a function in Fourier series for a given range - Half range sine and cosine expansions. One-dimensional wave equation and one-dimensional heat flow equation - method

of separation of variables - Fourier series solution.

Module 3: Probability (08 hrs)

Classical and axiomatic definition of probability, conditional probability, Bayes' theorem, independent events, random variables, expectation and higher order moments, probability mass function and probability density function, distribution function, Sample space, Events, Random Variables; Definitions of probability, conditional Probability, examples of discrete and continuous distributions: Normal, Poisson, Binomial distributions.

Module 4: Numerical Analysis (10 hrs)

Numerical solution of algebraic and transcendental equations by Regula-Falsi method Newton-Raphson's method; Finite Differences - Newton's Forward, backward difference interpolation formulae - Lagrange interpolation; Numerical Integration with Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule; Solving first order differential equations –Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta method of 4th order.

References / Suggested Learning Resources:-

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 1965.
2. Rajnish Verma & H.K. Dass, Higher Engineering Mathematics, S Chand, 2014.
3. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993
4. Jain, Iyengar and Jain, Numerical methods for Scientific and Engineering Computation, New Age International Publications, 2008.
5. Erwyn Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition, 2008.

BIOLOGY FOR ENGINEERS

Course Code	BS-303
Course Title	Biology for Engineers
Number of Credits	2 (L: 2, T: 0, P: 0)
Prerequisites	-
Course Category	Basic Science (BS)
Number of classes	26 hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Demonstrate the understanding of biology and its branches, major classifications of life, Cells, Cellular systems their functions and biological molecules.	K2
CO-2	Illustrate the molecular basis of genetic information and the flow of genetic information from DNA to RNA to protein and the concept of mutations, re-combinations and its applications.	K2
CO-3	Classify microorganisms, growth, nutrition with their various methods used for the isolation, identification, control and maintenance of microbial cultures.	K4
CO-4	Explain the fundamental principles of energy transactions in physical and biological and physiological systems, basic metabolisms.	K2

Course Content:

Module 1: Introduction to Biology, Classification and Biomolecules (8 hours)

Detailed content of the module: Introduction to Biology and its branches. Molecular taxonomy- three major kingdoms of life. Prokaryotic and Eukaryotic cells. Energy and Carbon utilization. Cells: Animal and Plant cell structures and functions. Cell cycle and Cell division. Transport across cell membrane. Cell signaling. Molecules of life. Monomeric units and polymeric structures. Sugars, starch and cellulose. Lipids, Amino acids and proteins. Nucleotides, DNA and RNA. Proteins- structure and function. Proteins as enzymes, transporters, receptors and structural elements. Enzyme classification. Mechanism of enzyme action. Enzyme kinetics.

Module 2: Fundamentals of genetics and flow of informations (6 hours)

Detailed content of the module: General principles of genetics, Concept of segregation and independent assortment. Molecular basis of information transfer, molecular basis of coding and decoding genetic information. DNA as genetic material. Concept of genetic code. Define gene in terms of complementation and recombination. Mutation. Recombinant DNA technology. Gene mapping. Application of recombinant DNA technology, recombinant products available in the market and at laboratory scale.

Module 3: Microbiology and applications (6 hours)

Detailed content of the module: Microorganisms and environment: Identification and classification of microorganisms. Ecological aspects of single celled organisms. Microbial integrations. Growth, nutrition and reproduction. Growth kinetics. Isolation and identification of microorganisms. Pure cultures and their characteristics. Maintenance of cultures. Sterilization. Physical and chemical methods of control of microorganisms. Management of toxic industrial wastes.

Module 4: Fundamentals of energy transaction and metabolism (6 hours)

Detailed content of the module: Thermodynamics –laws and its application in biological systems. Energy yielding and energy consuming biochemical processes. Metabolism- Glycolysis & Krebs cycle, Role of ATP and concept of energy change. Equilibrium constant.

Physiological steady-state, Living body as a thermodynamic system. Fundamental aspects of analysis of living systems; quantitative aspects of physiology and engineering applications to clinical medicine based on body fluid balance, solute transport, basic endocrinology, reproduction physiology, neurophysiology, skeletal and smooth muscle physiology.

References / Suggested Learning Resources:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd. 12th Edition, 2020
2. Guyton and Hall, Medical Physiology, 14th Edition, Elsevier Saunders, 2020.
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4. Principles of Genetics, D. Peter Snustad and Michael J. Simmons. 7th Edition, Wiley Publisher, 2015
5. Prescott’s Microbiology, Joanne Willey and Kathleen Sandman and Dorothy Wood, 2020. 11th Edition McGraw Hill

ENGINEERING MECHANICS

Course Code	ES 304
Course Title	Engineering Mechanics
Number of Credits	3 (L: 2, T: 1, P: 0)
Prerequisites	Physics
Course Category	Engineering Science (ES)
Number of classes	36 hours

Course Outcome:-

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

CO No	CO Description	K-level
CO-1	Differentiate coplanar, concurrent & non-concurrent forces and their resultants and confidently tackle equilibrium equations and its applications.	K3
CO-2	Explain centroid of simple figures, centre of gravity, moment of inertia of composite sections & mass moment of inertia of circular plates, cylinder, cone, sphere & hook.	K2
CO-3	Analyze simple truss, compound truss, frame & virtual work.	K4
CO-4	Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, analyze D’Alembert’s principle and	K2

	differentiate longitudinal, transverse, torsional and damped vibrations.	
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Course Content:-

Module 1: Fundamentals of Engineering Mechanics: (9 Periods):

Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy -Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

Module 2: Centre of Gravity & Moment of Inertia: (9 Periods):

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; -Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Module 3: Trusses, Frames & Virtual Work: (9 Periods)

Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module 4: Dynamics & Mechanical Vibrations: (9 Periods):

Dynamics - Basic terms & General principles of dynamics, Types of motion, Instantaneous centre of rotation in plane motion, D'Alembert's principle and its application, Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. Vibration - Basic concepts of Longitudinal, Transverse and Torsional vibrations, Free & Forced vibration, Resonance and its effects, Damped vibration.

Text Books / References:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, -Dynamics, 9th Ed, Tata McGraw Hill

3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
11. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education.
12. Bansal R.K. (2010), A Text Book of Engineering Mechanics by Laxmi Publications.
13. Irving, H. Shames, Engineering Mechanics-Statics and Dynamics, by Prentice-Hall of India.
14. Khurmi R. S. (2010), Engineering Mechanics, S. Chand & Co.
15. NPTEL web or video courses on Engineering Mechanics.
16. Timoshenko & D.H. Young, Engineering Mechanics, Tata McGraw-Hill publishing Co. Ltd.

ELECTRICAL CIRCUITS ANALYSIS

Course Code	PCEE-305
Course Title	Electrical Circuits Analysis
Number of Credits	4 (L : 3, T :1, P:0)
Prerequisites	Basic Electrical Engineering, Mathematics-differential equations and Laplace Transformation
Course category	Program Core-1
Number of Classes	48

Course outcomes

CO Number	Course description	K-level
	After the completion of the course students will be able to	
PCEE-305:OC.01	Apply Network theorems for the analysis of Electrical Circuits.	K3
PCEE-305:OC.02	Understand about the applications of transient and steady-state response of Electrical Circuits.	K2
PCEE-305:OC.03	Understand the applications of Standard test signals, periodic wave forms and Indefinite Admittance Matrices in Electrical circuits and their Analysis.	K2
PCEE-305:OC.04	Apply the Fourier series analysis and use of Network	K3

Module 1: Network Theorems, Resonance & Magnetically coupled Circuits (12 Hours)

Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Magnetically Coupled Circuits: Mutual Coupled Circuits, Dot convention, numerical analysis of magnetically coupled circuits. Resonance in series & Parallel Circuits.

Module 2 : Transient & Steady-state Analysis of Electrical Circuits (12 Hours)

Review of Laplace transformation, Standard Signals and their Laplace Transformation, Independent and dependent sources and equivalence of sources. Circuit elements and their transformed equivalents, Transient and steady-state response of R-L, R-C and RLC circuits in transient with or without stored energy – solutions in t & s domains. Concept of Transfer function, natural frequency and damping ratio and Poles & Zeroes. Sketching transient response, determination of peak values. Practical applications. Loop and node variable analysis of transformed circuits.

Module 3: Standard Signals and IAM in Electrical Circuits (12 Hours)

Standard test signals and their Laplace Transformations, Laplace transformation of standard periodic waveforms and responses in Series circuits due to standard signals & periodic wave forms. Concept of cascade connected network systems and their time responses. Relationships between time responses due to input of standard signals, Convolution integral & Dhumel's Integral and their applications in Electrical Circuits, Indefinite admittance matrix (IAM) and its applications in active & Passive circuits.

Module 4: Fourier Series, Fourier Transforms and Two Port Networks (12 Hours)

Fourier series of periodic functions and waveforms and their applications in electrical circuits. Fourier transform of periodic functions, Some properties of Fourier transform, Parseval's theorem and its applications. Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks – and their Analysis.

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. S. Ghosh, Network Theory Analysis and Synthesis, Prentice Hall India, 2005

ANALOG ELECTRONICS

Course Code	PC EE 306
Course Title	Analog Electronics
Number of Credits	4 (L: 3; T: 1; P: 0)
Prerequisites	Physics
Course Category	Program Core-2
Number of Classes	48

Course Outcome: After Completion of this course students will able to

CO Number	CO Description	K-level
CO-1	Explain the characteristics of transistors.	K2
CO-2	Illustrate various rectifier and amplifier circuits.	K4
CO-3	Model sinusoidal and non-sinusoidal oscillators.	K3
CO-4	Demonstrate the functioning of OP-AMP and model of OP-AMP based circuits.	K3

Module 1: Diode and BJT Circuits (12 Hours):

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits. Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, Biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.

Module 2: MOSFET circuits (12 Hours):

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

Module 3: Differential, multi-stage and operational amplifiers (10 Hours):

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

Module 4: Linear and Nonlinear applications of op-amp (14 Hours):

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. Nonlinear applications of op-amp Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak

detector. Monoshot.

References / Suggested Learning Resources:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.
6. V.K. Mehta, “Principles of Electronics”, S Chand, 2004
7. Robert Boylestad and Louis Nashelsky, “Electronic devices and circuit theory” Pearson Education India.

ELECTRICAL ESTIMATION & DESIGN PRACTICES

Course Code	PC EE 307
Course Title	Electrical Estimation & Design Practices
Number of Credits	1(L : 0, T :0, P:2)
Prerequisites	Basic Electrical Engineering
Course category	ProgramCore – 3
Number of Classes	24

Course Outcomes:

CO Number	Course description	K-level
	After the completion of the course students will be able to	
CO1	Understand the electrical wiring systems for residential, commercial and industrial consumers.	K2
CO2	Understand various components of residential and commercial electrical systems.	K2
CO3	Categorize various lighting systems	K4
CO4	Analyze and select various Industrial electrical system.	K4

Module 1: Electrical System Components (7 Hours).

LT system wiring components, selection of cables, wires, switches, distribution box, metering

system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

Module 2: Residential and Commercial Electrical Systems (7 Hours)

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

Module 3: Illumination Systems (6 Hours)

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Module 4: Industrial Electrical Systems (4Hours):

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

Text/Reference Books

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

ELECTRICAL CIRCUITS LABORATORY

Course Code	PC EE308
Course Title	Electrical Circuits Laboratory
Number of Credits	1(L : 0, T :0, P:2)

Prerequisites	Basic Electrical Engineering, Mathematics-differential equations and Laplace Transformation.
Course Category	Program Core-4
Number of Classes	24

Course outcomes

Course Outcomes:	CO description	Knowledge Level
	After Completing this course, students will be able to	
PCEE-308:OC.01	Understand to apply condition of resonance in Electrical Circuits and also to determine the Circuit Parameters and Mutually Coupled Circuits analysis.	K2
PCEE-308:OC.02	Determine the Transient and Steady-state performances of Electrical Circuits	K3
PCEE-308:OC.03	Analyze characteristics and time responses of Electrical Circuits due to different continuous signals.	K4
PCEE-308:OC.04	Determine the Parameters of Two Port Networks and their applications in the higher courses of Electrical Engineering	K3

Course Content:

List of experiments

1. Experiments for the Proof of Thevenin's and Maximum Power Transfer Theorem.
2. Study of series R-L-C Resonance Circuits and determination of Resonance frequency and Bandwidth.
3. Study of Transient Responses of R-L & R C series circuits and determination of time constants of these circuits.
4. Study of Transient Characteristics of R-L-C series Circuit and observation of Characteristics of Under damped, Over damped and Critically damped 2nd Order R-L-C Circuit by varying circuit elements.
5. Study of Characteristics of time responses of Series Circuits due to continuous periodic Triangular wave form at different frequency.
6. Study of frequency response of 1st order and 2nd Order series Circuits and determination of Transfer Function of Circuits.
7. Determination of Open Circuit Z-parameters and Short Circuit Y-Parameters of a two Port D.C. circuit and verifications of them.
8. Determination of Transmission and hybrid Parameters of a two Port D.C. Network.
9. Determination of overall Short Circuit Y Parameters of a Parallel connected two Identical two port Networks.

10. Determination of overall Transmission Parameters of Cascade combination of two identical two ports Network.

Text / References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
6. S. Ghosh, Network Theory Analysis and Synthesis, Prentice Hall India, 2005

ANALOG ELECTRONICS LABORATORY

Course Code	PC EE 309
Course Title	Analog Electronics laboratory
Number of Credits	1 (L: 0; T: 0; P: 0)
Prerequisites	Physics
Course Category	Program Core-5
Number of Classes	24

Course Outcome: After Completion of this course students will able to

CO Number	CO Description	K-level
CO-1	Determine the value of Resistance by colour codes, use of different components used in Electronic Circuits and their testing methods.	K3
CO-2	Explain the Characteristics of Diodes, Transistors and their applications.	K2
CO-3	Demonstrate the basics of different Transistorised Amplifiers in the fields of Electrical Engineering	K3
CO-4	Interpret the applications of Rectifiers and their characteristics.	K2
CO-5	Explain different types of Oscillators.	K2

Course Content:

List of experiments

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs), Identification, Specifications, Testing of Active Devices – Diodes, Power Transistors.
2. Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes: Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO. Component testing by CRO.
3. Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias and C) Zener Diode Characteristics.
4. Study of Characteristics of Semiconductor diode based Half wave and Full Wave Rectifiers.
5. Study of different Biasing Techniques of Transistors at different modes.
6. Study of Input and Output Characteristics of Common Emitter (CE), Common base (CB) Transistor Amplifiers.
7. Study of Characteristics of Class A, AB and Push Pull Transistorized Amplifiers.
8. Study of Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration.
9. Study of Transistorized RC Phase Shift and Wien bridge Oscillators.

References / Suggested Learning Resources:

- 1 S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
- 2 J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
- 3 J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
- 4 P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
- 5 P.R. Gray, R.G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.
- 6 V.K. Mehta, “Principles of Electronics”, S Chand, 2004