CENTRAL UNIVERSITY OF KARNATAKA
KALABURAGI

SCHOOL OF ENGINEERING

COURSE STRUCTURE AND SYLLABUS

B.Tech. First Year -2020 Batch

ELECTRICAL ENGINEERING

Learning Outcomes-based Curriculum Framework

(Effective from the academic year 2020 –21)

Department of Electrical Engineering
School of Engineering
Central University of Karnataka
Kalaburagi-585367

SCHOOL OF ENGINEERING

COURSE STRUCTURE - FIRST YEAR B. TECH

ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

I SEMESTER											
Course code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UECTCC1001	CC	Engineering Physics	3	1	-	4	3	30	45	75	3
UECTCC1002	CC	Engineering Mathematics-I	3	1	-	4	3	30	45	75	3
UECTCC1003	CC	Introduction to Electrical Engineering	3	1	-	4	3	30	45	75	3
UECTCC1004	CC	Programming for Problem Solving	3	1	-	4	3	30	45	75	3
UECPCC1005	CC	Computer Aided Engineering Drawing	1	-	3	4	3	30	45	75	3
UECPCC1006	CC	Programming for Problem Solving Lab	-	-	3	3	3	20	30	50	2
UECPCC1007	CC	Basic Electrical Lab	-	-	3	3	3	20	30	50	2
UECTGE1091	GE	Environmental Science	3	-	-	3	3	20	30	50	2
		Total	**16**	**4**	**9**	**29**	**24**	**210**	**315**	**525**	**21**

Note: 1. CC-Core Course, DS-Discipline Specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses

2. Environmental Science is a mandatory non-graded course. This course shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

SCHOOL OF ENGINEERING

COURSE STRUCTURE - FIRST YEAR B. TECH

ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

II SEMESTER											
Course code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UECTCC2008	CC	Engineering Chemistry	3	1	-	4	3	30	45	75	3
UECTCC2009	CC	Engineering Mathematics-II	3	1	-	4	3	30	45	75	3
UECTCC2010	CC	Introduction to Electronics Engineering	3	1	-	4	3	30	45	75	3
UECTCC2011	CC	Introduction to Mechanical Engineering	3	-	-	3	3	30	45	75	3
UECTCC2012	CC	Elements of Civil Engineering	3	-	-	3	3	30	45	75	3
UECPCC2013	CC	Basic Electronics Lab	-	-	3	3	3	20	30	50	2
UECTGE2092	GE	English Enhancement Course	-	-	3	3	3	20	30	50	2
UECTGE2093	GE	Constitutions of India and Professional Ethics	3	-	-	3	3	20	30	50	2
		Total	**18**	**3**	**6**	**27**	**24**	**210**	**315**	**525**	**21**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses

2. English Enhancement and Constitutions of India & Professional Ethics are mandatory non-credit courses. These courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

COURSE CONTENT/SYLLABUS

SEMESTER- I

ENGINEERING PHYSICS			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECTCC1001**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITE(S)

Basic Physics

COURSE OUTCOMES

After completion of this course the student will be able to

- Solve 1 D problems in quantum mechanics
- Explain the basis of energy bands and gaps in solids and semiconductors
- Analyze and solve problem involving variety of wave phenomena
- Apply principles of electromagnetism and Maxwells equation to simple systems
- Explain principles and techniques used in the field of nanoscience

DETAILED SYLLABUS

UNIT-I

Waves and Oscillations: Rectilinear motion, Oscillations or Vibrations, Simple Harmonic Motion, Damped Harmonic motion: Real oscillatory system, Forced or Driven oscillation, Types of Wave; Superposition of Waves, Reflection and Refraction, Standing Waves and Normal Modes, Beats, Resonance, Doppler's Effect

UNIT-II

Electricity and Magnetism: Physical concepts of gradient, divergence, and curl; Laplacian operator, Concept of electricity and magnetism, Coulomb's law, The Lorentz force, Maxwell's equations

UNIT-III

Introduction to Solids and Semiconductors: Introduction to Quantum Mechanics, Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Kronig-Penney model and origin of energy bands, metals, semiconductors, and insulators.

UNIT-IV

Introduction to nanoscience: Origin of nanoscience, nanoscale, surface to volume ratio, quantum confinement, dominance of electromagnetic forces, random molecular motion,

bottom-up fabrication: Sol-gel, CVD and PVD techniques, top-down fabrication: ball mill method, characterization by XRD, SEM and TEM.

TEXT BOOKS

1. Griffiths, D.J. and Schroeter, D.F., 2018. Introduction to quantum mechanics. Cambridge University Press.
2. Griffiths DJ. Introduction to electrodynamics.
3. The Feynman Lectures on Physics, vol. 2,.
4. Fitzpatrick, R., 2018. Oscillations and waves: an introduction. CRC Press.
5. Solid State Physics, A. J. Dekkar, Macmillan publishers Ind. Ltd.,
6. Solid State Physics, Charles Kittel, Wiley student edition.
7. Fundamentals of Physics, Alan Giambattisa, BM Richardson and Robert C Richardson, Tata McGraw hill Publishers.

REFERENCES

1. G. Main, “Vibrations and waves in physics”, Cambridge University Press, 1993.
2. H. J. Pain, “The physics of vibrations and waves”, Wiley, 2006.
3. D. A. Neamen, “Semiconductor Physics and Devices”, Times Mirror High Education Group, Chicago, 1997.
4. E.S. Yang, “Microelectronic Devices”, McGraw Hill, Singapore, 1988.
5. B.G. Streetman, “Solid State Electronic Devices”, Prentice Hall of India, 1995.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

ENGINEERING MATHEMATICS-I			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECTCC1002**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
	Credits: 03		

Prerequisite Course / Knowledge (If any):

None

Course Learning Outcomes (CLOs)

After completion of this course successfully, the students will be able to

CLO-1: Solve the consistent system of linear equations

CLO-2: Apply orthogonal and congruent transformations to a quadratic form

CLO-3: Determine the power series expansion of a given function

CLO-4: Find the maxima and minima of multivariable functions

CLO-5: Solve arbitrary order linear differential equations with constant coefficients

CLO-6: Apply the concepts in solving physical problems arising in engineering

DETAILED SYLLABUS

UNIT I

Matrix Theory: Linear dependence and independence of vectors; Rank of a matrix; Consistency of the system of linear equations; Eigenvalues and eigenvectors of a matrix; Caley-Hamilton theorem and its applications; Reduction to diagonal form; Reduction of a quadratic form to canonical form - orthogonal transformation and congruent transformation; Properties of complex matrices - Hermitian, skew-Hermitian and Unitary matrices.

UNIT II

Differential Calculus: Taylor's theorem with remainders; Taylor's and Maclaurin's expansions; Asymptotes; Curvature; Curve tracing; Functions of several variables - partial differentiation; total differentiation; Euler's theorem and generalization; Change of variables - Jacobians; maxima and minima of functions of several variables (2 and 3 variables) - Lagrange's method of multipliers.

UNIT III

Ordinary differential equations of first order: Formation of differential equations; variable separable equations; homogeneous and non-homogeneous equations; exact and non-exact equations; integrating factors; linear first order equations; Bernoulli’s equation; applications- Newton’s law of cooling, Law of natural growth and decay, orthogonal trajectories.

UNIT IV

Linear Differential Equations of Higher order: Definition, Complete solution, Operator D, Rules for finding complementary function, Inverse operator, Rules for finding particular integral, Method of variation of parameters, Cauchy’s and Legendre’s linear equations, Simultaneous linear equations with constant coefficients and applications of linear differential equations to oscillatory Electrical Circuits L-C, LCR – Circuits.

Reference Books

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons, 2015

3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 2015

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

INTRODUCTION TO ELECTRICAL ENGINEERING			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECTCC1003**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITE(S)

Physics fundamental, Electromagnetic basics, Linear algebra, vector analysis, matrix analysis and complex numbers.

COURSE OUTCOMES

After Completion of the course the student should able to

CO1- Apply basic laws and analyse electrical circuits.

CO2- Understand transformer working principle and its usage.

CO3- Understand electrical machines working principle and their applications.

CO4- Understand LT and domestic electrical safety, wiring and different measuring instrument and their use.

DETAILED SYLLABUS

Unit I

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

RBT levels: L1, L2

Unit II

Magnetic materials, BH characteristics, series and parallel magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

RBT levels: L1, L2

Unit-III

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, loss components, efficiency and applications. Construction, working, torque-speed characteristic and applications of separately excited dc motor. Construction and working of synchronous generators.

RBT levels: L1, L2, L3

Unit IV

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup. Lamps-fluorescent, CFL, LED. Electrical measuring instruments principle and applications- energy meter, megger, tong tester. Electrical Wiring

RBT levels: L1, L2

Text/Reference books

1. Fitzgerald, D. E. Higginbotham, A. Grabel, Basic Electrical Engineering, 5th Edition, McGraw-Hill, 2009.
2. William H. Hayt Jr. , Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, 6th Edition,TMH, 2002
3. Olle I. Elgerd, Basic Electric Power Engineering, Addison-Wesley, 1977. Edward Hughes, Electrical Technology,7th Edition, Longman, 1995.
4. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, 3rd edition 2010, Tata McGraw Hill.
5. L.S. Bobrow, Fundamentals of Electrical Engineering", Oxford University Press, 2011
6. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson, 2010

Course Assessment

A. Internal Assessment: (40 Marks)

- Internal assessment – 20-30 marks
- Remaining 10-20 marks can be divided among- assignment/surprise test/seminar/ Quiz/attendance/class work

(no. of assignment, surprise test, quiz and seminar can be decided by faculty)

B. End semester examination (60 marks)

- One full question carries 12 marks- Each questions my contains sub divisions form different units.
- Marks need to be properly distributed among the units.

- Five full questions should be answered
- Total no. of questions -8

PROGRAMMING FOR PROBLEM SOLVING			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECTCC1004**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITE(S)

- Mathematics (Algebra, Geometry etc.) knowledge, Analytical and Logical skills.

COURSE OUTCOMES

On completion of this course, the students will be able to:

CO1- Understand concept of algorithms and flowcharts for solving problems.

CO2- Understand the basic principles of Programming in C language.

CO3- Develop the problem-solving skills using C language.

CO3- Decompose a problem into functions and to develop modular reusable code.

CO4- Apply the concepts of arrays, pointers, strings and structures to write C programs.

DETAILED SYLLABUS

UNIT-1

Introduction to Computer Problem Solving: Steps in solving logical and numerical problems. Representation of Algorithm, Flowchart and Pseudo code with examples. Program design and structured programming.

Introduction to 'C' Programming Language: Background, Basic structure of C program, executing a C program. Constant, variables and data types, operators and expressions.

RBT levels: L1, L2

UNIT-2

Conditional Branching and Loops: Conditional branching Statements (if, if-else, nested if-else and switch statements) in C, Loop control statements (For, while-do, do-while) in C, break and continue, Programming examples and exercises.

Managing Input and Output operations: Simple input and output with scanf and printf, formatted I/O, Command line arguments.

RBT levels: L1, L2

UNIT-3

Arrays: Concepts, Using Arrays (1-D and 2-D) in C, Array Applications, Searching and Sorting algorithms (Linear search, Binary Search, Selection and Bubble Sort), example programs.

Strings: Introduction to strings in C, handling strings as array of characters, basic string functions available in C, arrays of strings.

Functions: Functions in C, user defined functions, Argument Passing – call by value, call by reference, Recursion, Programming examples and exercises.

RBT levels: L1, L2, L3

UNIT-4

Structures: Basics of structures, Definition and Initialization of structures, unions, Array of structures, example programs.

Pointers: Idea of pointers, Defining pointers, pointers and functions (call by reference) arguments, pointers and arrays, example programs.
Pre-processor directives: Introduction to Preprocessors, compiler control Directives.

RBT levels: L1, L2, L3

TEXT BOOKS

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw-Hill
2. Brian W. Kernighan and Dennis M. Ritchie, The “C” Programming Language, Prentice Hall of India
3. V Rajaraman: Computer Programming in C, PHI, 2013.

REFERENCE BOOKS

1. Jacqueline Jones & Keith Harrow: Problem Solving with C, 1st Edition, Pearson 2011
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. Vikas Gupta: Computer Concepts and C Programming, Dreamtech Press 2013.
4. R S Bichkar, Programming with C, University Press, 2012.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

COMPUTER AIDED ENGINEERING DRAWING			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECPCC1005**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**1:0:3**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITE(S)

None

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the points and lines with all quadrant systems.

CO2. Apply the concepts of planes to draw the projections.

CO3. Apply the concepts of solids to draw the projections.

CO4. Apply the knowledge of isometric concept for drawing the projections.

DETAILED SYLLABUS

UNIT-I

Introduction to Computer Aided Sketching: Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Introduction to Solid Edge standard tool bar/menus. Co-ordinate system, points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning conventions.

Orthographic Projections: Projections of points, Projections of straight lines (First Angle Projection), True and apparent lengths.

RBT Levels: L1, L2.

UNIT-II

Orthographic Projections of Plane Surfaces: Projections of plane surfaces.

RBT Levels: L1, L2, L3.

UNIT-III

Projections of Solids: Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

RBT Levels: L1, L2, L3.

UNIT-IV

Isometric Projection: Isometric scale, projection of plane figures, solids: tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, truncated solids, combinations.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.
2. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belgaum.
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer
4. Graphics for Design and Production- by Luzadder Warren J., Duff John M., Eastern Economy
5. Edition, 2005- Prentice Hall of India Pvt. Ltd., New Delhi.
6. Engineering Graphics by K.R. Gopalakrishna, 32nd edition, 2005- Subash Publishers Bangalore.

REFERENCE BOOKS

1. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
2. Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication
3. Engineering Graphics & Design, A.P. Gautam & Pradeep Jain Khanna Publishing House
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers. (Corresponding set of) CAD Software Theory and User Manuals.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/#

COURSE ASSESSMENT

A. Continuous Assessment: (40%)

B. End Semester Examination (60 %)

PROGRAMMING FOR PROBLEM SOLVING LABORATORY			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECPCC1006**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**0:0:3**	**Exam Duration (Hours)**	**02**
Credits: 02			

PREREQUISITES

- Mathematics (Algebra, Geometry etc.) knowledge, Analytical and Logical skills.
- Knowledge of Algorithms and Flowcharts

COURSE OUTCOMES

On completion of this lab, the students should be able to:

- Develop algorithms, flowchart and programs for solving problems.
- Identify and correct the syntax and logical errors of the program.
- Design and develop modular programming skills
- Develop Iterative and Recursive programs based on the requirement
- Apply the concepts of arrays, pointers, strings and structures to write C programs.

LABORATORY PROGRAMS

PART-A

1. Develop a program to compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages.
2. Develop a program to find the reverse of a positive integer and check for palindrome or not. Display appropriate messages.
3. Develop a program to find the square root of a given number N and execute for all possible inputs with appropriate messages. Note: Don’t use library function sqrt(n).
4. Develop a program to implement Binary search using 1D array.
5. Develop a program to introduce 2D Array manipulation and implement Matrix multiplication and ensure the rules of multiplication are checked.
6. Develop a program to sort the given set of N numbers using Bubble sort.

PART-B

7. Develop a function isprime(num) that accepts an integer argument and returns 1 if the argument is prime, a 0 otherwise. Write a program that invokes this function to generate prime numbers between the given range.
8. Write functions to implement string operations such as compare, concatenate, string length. Convince the parameter passing techniques.
9. Implement Recursive function to generate Fibonacci series.

10. Implement Recursive function for Binary to Decimal conversions.
11. Write a program to maintain a record of n student details using an array of structures with four fields (Roll number, Name, Marks, and Grade). Assume appropriate data type for each field. Print the marks of the student, given the student name as input.
12. Write a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of n real numbers.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

INSTRUCTIONS (if any):

- Every experiment should have an algorithm and flowchart be written before writing the program.
- Code should be traced using minimum two test cases which should be recorded
- Implement the programs with WINDOWS / LINUX platform using appropriate C compiler.

BASIC ELECTRICAL LABORATORY			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECPCC1007**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**0:0:3**	**Exam Duration (minutes)**	**90**
Credits: 02			

PREREQUISITES

1. Theory of Basic Electrical Engineering
2. Engineering Mathematics

COURSE OUTCOMES

After completing this Course, the students should be able to:

1. Identify the common electrical components and measuring instruments used for conducting
2. Calculate and Analyze power consumed and power factor of lamps.
3. Determine the impedance of an electric circuit and power consumed in a three-phase load.
4. Measure the earth resistance and understand the usage of Megger.
5. Understanding the difference between single phase and three phase systems.

LIST OF EXPERIMENTS

Sl.No	List of Experiments
1.	Understanding basic electrical components, tools, domestic wiring and meters.
2.	Measurement of current,power, and power factor of incandescent lamp, Fluorescent lamp and LED lamp.
3.	Measurement of resistance and inductance of a choke using 3 voltmeter method.
4.	Verification of KCL and KVL for DC Circuit.
5.	Study of effect of open and short circuit in simple circuit.
6.	Two way and three-way control of lamp and formation of truth table.
7.	Measurement of earth resistance and understanding the usage of megger.
8.	Verification of Thevenin's and Norton's theorems.
9.	Measurement of three phase power using two wattmeter method
10.	Determination of phase and line quantities in three phase star and delta connected loads.
11.	Demonstration of cut-out sections of machines.
12.	Demonstration of significance of Pipe and Plate Earthing

TEXT BOOKS

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.

REFERENCE BOOKS

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

ONLINE RESOURCES

1. https://nptel.ac.in/courses//

COURSE ASSESSMENT

A. Continuous Assessment: (40%)

B. End Semester Examination (60 %)

ENVIRONMENTAL SCIENCE			
Semester	**I**	**Internal Assessment**	**30**
Course Code	**UECTGE1091**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:0:0**	**Exam Duration (minutes)**	**90**
Credits: 02			

PREREQUISITIES

- Concept of environment.
- Basics of environment, ecology and technology.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Identify the Components of Environment Ecosystem: Types & Structure, Scope and the Impacts of Agriculture & Housing, Industry, Mining & Transportation.
CO2. Ascertain the importance of. Natural Resources and different types of Energy.
CO3. Comprehend the Environmental Pollutions and Global Environmental Issues.
CO4. Examine the Air Pollution & Automobile Pollution their Effects and Solid Waste Management their sources, Characteristics.

DETAILED SYLLABUS

UNIT-I

Introduction: Environment - Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation. Environmental Impact Assessment, Sustainable Development.
RBT Levels: L1, L2.

UNIT-II

Natural Resources, Water resources: Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle.
Energy: Different types of energy, Conventional sources & Non-Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.
RBT Levels: L1, L2.

UNIT-III

Environmental Pollution: Water Pollution, Noise pollution, Land Pollution, Public Health Aspects.

Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.

RBT Levels: L1, L2.

UNIT-IV

Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures.

Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.

RBT Levels: L1, L2, L3.

TEXT BOOKS

1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005,
4. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012

REFERENCE BOOKS

1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005 63 64
2. 2. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006
3. S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007 4. Erach Bharucha, "Text Book of Environmental Studies", for UGC, University press, 2005
4. Erach Bharucha, "Text Book of Environmental Studies", for UGC, University press, 2005
5. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Tenth Edition, Thomson Brooks /Cole, 2004
6. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr.Pratiba Sing, Dr.Anoop Singh and Dr.Piyush Malaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi

COURSE ASSESSMENT

A. Continuous Assessment: (40%)

B. End Semester Examination (60 %)

SEMESTER- II

ENGINEERING CHEMISTRY			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTCC2008**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITE(S)

Basic Chemistry

COURSE LEARNING OUTCOMES

After completion of this course successfully, the students will be able to

CLO-1: Apply the chemistry knowledge in solving engineering problems of society.
CLO-2: Understand the fundamentals of electrochemistry, polymer chemistry and water technology
CLO-3: Assemble the concepts of chemistry that are in immediate need for engineering disciplines.
CLO-4: Analyze various technologies available in electrochemistry, polymer chemistry, water & fuels.
CLO-5: Develop problem solving skills using chemistry knowledge in an integrated approach.

DETAILED SYLLABUS

UNIT-I

Electrochemistry: Electro chemical cells – electrode potential, standard electrode potential, types of electrodes – calomel, Quinhydrone and glass electrode. Nernst equation Determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Numerical problems. Potentiometric titrations. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

Corrosion: Causes and effects of corrosion, Types of corrosion ,Corrosion control methods

Battery Technology: Classification of batteries, emf of batteries, Modern batteries. Fuel cells and their applications.

UNIT-II

Polymer Chemistry: Introduction, Classification of polymers, Use and disposal of polymers, Polymer terminologies, commercially important polymers with synthesis and applications (plastics, fibres, adhesives, elastomers, conducting polymers), properties of polymers-Solubility, Molecular Weight, Crystallinity, Glass transition temperature, Role of additives in polymers, Reinforced plastics.

UNIT-III

Water Technology: Chemical analysis of water. Hardness of water. Determination of dissolved oxygen (DO) by Winkler or Iodometric method. Reverse osmosis. Source of water pollution. Chemical oxygen demand (COD) and Biological oxygen demand (BOD). Treatment of domestic waste. Nano-technology associated with water.

UNIT-IV

Chemical fuels: Introduction, classification with examples, calorific value-classification (HCV & LCV), determination of calorific value of solid and liquid fuels using Bomb calorimeter-numerical problems. Petroleum cracking -fluidized bed catalytic cracking. Reformation of petrol, Knocking in IC engine, its ill effects and prevention. Power alcohol and its advantages. Synthetic petrol – Bergius process. Renewable and non-renewable energies. Biofuel. Solar Energy. Nuclear fuel.

TEXT BOOKS

1. Text book of Engineering Chemistry by Dr. K. Pushpalatha, published by Wiley publications 2nd edition.
2. A text book of Engineering Chemistry 15th Edition by P.C.Jain and Monica Jain, Dhanpat Rai Publishing Co (P) Ltd., New Delhi.
3. A textbook of Engineering Chemistry: Jain and Jain, Dhanpatrai Publication.
4. A textbook of Engineering Chemistry: S. S. Dara, S. Chand Publication 2010 edn.
5. A textbook of Engineering Chemistry: Shashi Chawla, Dhanpatrai Publication

REFERENCES

1. Principles of Physical Chemistry by B.R.Puri, L.R.Sharma and M.S.Pathania, Nagin Chand and Co.
2. Text book of Physical Chemistry by Soni and Dharmatha, S.Chand & Sons.
3. Text book of Polymers science by Gowarikar and Vishwanathan.
4. Corrosion Engineering by M.G.Fontana, Mc Graw Hill Publications.
5. Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)

B. End Semester Examination (60 %)

CENTRAL UNIVERSITY OF KARNATAKA	**Central University of Karnataka** (Established by an Act of the Parliament in 2009) **School of Engineering**	**Dept.: ECE & EE** **First Year Course Structure & Syllabus** **2020-21**

ENGINEERING MATHEMATICS-II			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTCC2009**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITES:

Mathematics-I

COURSE OUTCOMES

After completion of this course successfully, the students will be able to
CLO-1: Analyse improper integrals
CLO-2: Evaluate multiple integrals in various coordinate systems
CLO-3: Apply the concepts of gradient, divergence and curl to formulate engineering problems
CLO-4: Convert line integrals into area integrals and surface integrals into volume integrals
CLO-5: Apply Laplace transforms to solve physical problems arising in engineering

DETAILED SYLLABUS

UNIT- I

Integral Calculus: Convergence of improper integrals; Beta and Gamma integrals; Differentiation under integral sign; Double and Triple integrals - computation of surface areas and volumes; change of variables in double and triple integrals.

UNIT- II

Vector Calculus: Scalar and vector fields; vector differentiation; level surfaces; directional derivative; gradient of a scalar field; divergence and curl of a vector field; Laplacian; Line and Surface integrals; Green's theorem in a plane; Stoke's theorem; Gauss Divergence theorem

UNIT-III

Laplace Transforms: Laplace transforms; inverse Laplace transforms; Properties of Laplace transforms; Laplace transforms of unit step function, impulse function, periodic function; Convolution theorem; Applications of Laplace transforms - solving certain initial value problems, solving system of linear differential equations, finding responses of systems to various inputs viz. sinusoidal inputs acting over a time interval, rectangular waves, impulses etc.

REFERENCE BOOKS

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Fifth Edition, Narosa Publishing House, 2016
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Eighth Edition, John Wiley and Sons, 2015
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, 2015

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

INTRODUCTION TO ELECTRONICS ENGINEERING			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTCC2010**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:1:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITES:

Need Experience with math courses such as Geometry, Physics and Algebra. Students able to figuring out voltage, distribution, and other circuit formulas.

COURSE OUTCOMES

After studying this course, students will be able to:

CO1. Describe the operation of Diodes and BJT
CO2. Design and explain the construction of rectifiers, regulators, and amplifiers.
CO3. Describe the general operating principles of optoelectronic devices and photodetectors.
CO4. Explain the different number system and their conversions and construct simple combinational and sequential logic circuits using Flip-flops

DETAILED SYLLABUS

UNIT- I

Semiconductors: Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect.

RBT Levels: L1, L2.

UNIT-II

Forward and Reverse biased junctions: Qualitative description of Current flow at a junction, Reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers.

Optoelectronic Devices, Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode.

RBT Levels: L1, L2.

UNIT- III

Bipolar Junction Transistor: Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

RBT Levels: L1, L2.

UNIT- IV

Digital Electronics Fundamentals: Difference between analog and digital signals, Number system – Binary, Hexadecimal, Coversion – Decimal to binary, Hexagonal to decimal and vice-versa, Boolean Algebra, Basic to Universal gates, Half and full adder, Multiplexer, Decoder, SR and JK flip-flops, Shift register, 3 bit Ripple counter.

RBT Levels: L1, L2, L3.

TEXT BOOKS

1. Ben. G. Streetman, Sanjay Kumar Banergee, “Solid State Electronic Devices”, 7th Edition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. D.P. Kothari, I.J. Nagarath, “Basic Electronics”, 2nd Edn. Mc Graw Hill, 2018.

REFERENCE BOOKS

1. Thomas L. Floyed, “Electronic Devices” Pearson Education, 9th Edition, 2012

2. S. M. Sze, Kwok K. Ng, “Physics of Semiconductor Devices”, 3rd Edition, Wiley, 2018.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

INTRODUCTION TO MECHANICAL ENGINEERING			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTCC2011**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:0:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITES:

Basics of Algebra and Trigonometry.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand different energy sources and their effective utilization.
CO2. Distinguish different types of turbines & Boilers and their uses.
CO3. Understand engineering materials and their uses.
CO4. Understand the concepts of automation and robotics.

DETAILED SYLLABUS

UNIT-I

Sources of Energy: Introduction and application of energy sources like fossil fuels, hydel, solar, wind, nuclear fuels and bio-fuels; environmental issues like global warming and ozone depletion.
Basic concepts of Thermodynamics: Introduction, states, concept of work, heat, temperature; Zeroth, 1st, 2nd and 3rd laws of thermodynamics. Concept of internal energy, enthalpy and entropy (simple numericals).

Steam: Formation of steam and thermodynamic properties of steam (simple numericals).

Boilers: Introduction to boilers, classification, Lancashire boiler, Babcock and Wilcox boiler. Introduction to boiler mountings and accessories (no sketches).

Turbines: Hydraulic Turbines – Classification and specification, Principles and operation of Pelton wheel turbine, Francis turbine and Kaplan turbine (elementary treatment only). Hydraulic Pumps: Introduction, classification and specification of pumps, reciprocating pump and centrifugal pump, concept of cavitation and priming.
RBT Levels: L1, L2.

UNIT-II

Engineering Materials: Types and applications of Ferrous & Nonferrous metals and alloys,
Composites: Introduction: Definition, Classification and applications (Air craft and Automobiles)

Soldering, Brazing and Welding: Definitions, classification and method of soldering, Brazing and welding. Differences between soldering, Brazing and Welding. Description of Electric Arc Welding and Oxy-Acetylene Welding
RBT Levels: L1, L2.

UNIT-III

Machine Tools and Automation Machine Tools Operations:
Turning, facing, knurling, Thread cutting, Taper Turning by swiveling the compound rest, Drilling, Boring, Reaming, Tapping, Counter Sinking, Counter Boring, -Plane milling, End milling, Slot milling.

Introduction to Advanced Manufacturing Systems Computer Numerical Control (CNC): Introduction, components of CNC, open loop and closed loop systems, advantages of CNC, CNC Machining centers and Turning centers.
RBT Levels: L1, L2.

UNIT-IV

Robotics: Introduction, classification based on robots configuration; Polar, cylindrical, Cartesian Coordinate and spherical. Application, Advantages, and disadvantages

Automation: Definition, types –Fixed, Programmable & Flexible automation, NC/ CNC machines: Basic elements with simple block diagrams, advantages and disadvantages.
RBT Levels: L1, L2.

TEXT BOOKS

1. S.TrymbakaMurthy, “A Text Book of Elements of Mechanical Engineering”, 4th Edition 2006, Universities Press (India) Pvt Ltd, Hyderabad.
2. Pravin Kumar, “Basic Mechanical Engineering”, 2013 Edition, Pearson.
3. K.R.Gopalkrishna, “A text Book of Elements of Mechanical Engineering”- Subhash Publishers, Bangalore. (Module -1,2,3,4,5)
4. Elements of Mechanical Engineering by K.P. Roy, S K Hajra Choudhury, A K Hajra Choudhury, Media Promoters, 2012

REFERENCE BOOKS

1. V.K.Manglik, “Elements of Mechanical Engineering”, PHI Publications, 2013. (Module 1,2,4,5)
2. MikellP.Groover, “Automation, Production Systems & CIM”, 3rd Edition, PHI (Module -3)
3. K.P.Roy, S.K.Hajra Choudhury, Nirjhar Roy, “Elements of Mechanical Engineering”, Media Promoters & Publishers Pvt Ltd,Mumbai,7th Edition,2012
4. Callister Jr, William D., and David G. Rethwisch. *Callister's Materials Science and Engineering*. John Wiley & Sons, 2020. (Adopted by R. Balasubramaniam)
5. Kaw, Autar K. *Mechanics of composite materials*. CRC press, 2005.
6. Nag, P. K. *Engineering thermodynamics*. Tata McGraw-Hill Education, 2013.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

ELEMENTS OF CIVIL ENGINEERING			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTCC2012**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**3:0:0**	**Exam Duration (Hours)**	**02**
Credits: 03			

PREREQUISITES

- Concept of civil engineering.
- Basics of buildings, infrastructure.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Identify the scope and importance of Civil Engineering and mention the applications of various fields of Civil Engineering.
CO2. Ascertain the importance of Roads, their Classification and explain infrastructure developments and its implications.
CO3. Comprehend the types of bridges and dams.
CO4. Examine the sustainability aspect in buildings and apply the concept of embodied energy.

DETAILED SYLLABUS

UNIT-I

History and Scope of different fields of Civil Engineering: History of Civil engineering, Building Materials, Civil Engineering Profession and Careers, Branches of Civil Engineering; Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources and Irrigation Engineering, Transportation Engineering, Environmental Engineering.
RBT Levels: L1, L2.

UNIT-II

Roads and Infrastructure: Importance and Classification of Roads and their functions, Comparison of Flexible and Rigid Pavements (Advantages and Limitations).
Types of infrastructure, Role of Civil Engineer in the Infrastructural Development, Effect of the infrastructural facilities on socioeconomic development of a country.
RBT Levels: L1, L2.

UNIT-III

Bridges and Dams: Types of Bridges and Culverts, RCC, Steel and Composite Bridges. Different types of Dams based on Material, Structural behavior and functionality with simple sketches.

RBT Levels: L1, L2.

UNIT-IV

Sustainability in Civil Engineering: Concept of Sustainability, Materials and Resources and Embodied Energy in Buildings, concept of Green Ratings.

RBT Levels: L1, L2, L3.

TEXT BOOKS

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015, Standard Publishers.
2. Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.
4. Howard S. Peavy, Donald R. Rowe, George T, Environmental Engineering - McGraw Hill International Edition. New York,2000
5. S. K. Garg, Environmental Engineering vol-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010.
6. R.S.Khurmi, J.K.Gupta, Civil Engineering, S Chand Pvt Ltd.
7. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi. 2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
8. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee. 2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
9. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub
10. Charles.J.Kibert, Sustainable Construction Green Building Design and Delivery, John Wiley & Sons, INC.

REFERENCE BOOKS

1. S. K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016 National Building Code(NBC) of India
2. B.C. Punmia, "Surveying Vol.1", Laxmi Publications pvt. Ltd., New Delhi –2009.
3. CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
4. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons. 2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
5. Relevant IRC Codes. 2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.

6. LEED India, Green Building Rating System, IGBC pub. 3. IGBC Green Homes Rating System, CII pub
7. Allen, D.T. and S honnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
8. Michael.F.Ashby, Materials and the Environment, Elsevier Butterworth-Heinemann, 2009.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/105/106/105106201/

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

BASIC ELECTRONICS LAB			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECPCC2013**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**0:0:3**	**Exam Duration (minutes)**	**90**
Credits: 02			

PREREQUISITE

- Understanding of semiconductors.
- Knowledge of PN junction and working.
- Understanding of BJT working and biasing.
- Understanding of FET working and biasing.

COURSE OUTCOMES

On the completion of this laboratory course, the students will be able to:

CO1. Examine the characteristics of basic semiconductor devices.
CO2. Perform experiments to study the behavior of semiconductor devices for circuit design applications.
CO3. Calculate various device parameter values from their IV characteristics.
CO4. Interpret the experimental data for better understanding the device behavior.

LIST OF EXPERIMENTS: (RBT Levels: L1, L2, L3, L4.)

1. Analyze the I-V Characteristics of normal PN Junction (Ordinary Diode).
2. Analyze the I-V Characteristics of Zener Diode (Special Diode).

3. Study and Analyze the I-V Characteristics of the CE Configuration of BJT.
4. Study and Analyze the I-V Characteristics of the CB Configuration of BJT.
5. Study and Analyze the I-V Characteristics of the CC Configuration of BJT.
6. Study and Analyze the I-V of JFET.
7. Design and analyze constant power supply using a Zener Diode.
8. To construct a Half-wave rectifier circuit and analyze its output.
9. To analyze the HW rectifier output using a capacitor in shunt as a filter.
10. To construct a Full-wave rectifier circuit and analyze its output.
11. To analyze the FW rectifier output using a capacitor in shunt as a filter.
12. To design and analyze regulated power supply using ICs (7805 and 7812).
13. To design and analyze regulated power supply using ICs (7905 and 7912).
14. Study the transfer function and phase shift of a low pass RC filter.
15. Study the transfer function and phase shift of a high pass RC filter.

COURSE ASSESSMENT

A. Continuous Assessment: (40%)

B. End Semester Examination (60 %)

ENGLISH ENHANCEMNT COURSE			
Semester	**II**	**Internal Assessment**	**30**
Course Code	**UECTGE2092**	**End Sem. Exam**	**45**
Teaching Hours/Week (L:T:P)	**0:0:3**	**Exam Duration (Minutes)**	**90**
Credits: 02			

PREREQUISITE(S)

Basic English and grammar knowledge.

COURSE OUTCOMES

After completion of this course successfully, the students will be able to…

CO1: Understand the purpose, summarize and paraphrase the information
CO2: Identify grammatical errors and correct them
CO3: Write a formal report and referencing properly.
CO4: Develop own style of sensible writing

DETAILED SYLLABUS

UNIT-I

1. READING SKILLS

1.1 Types of Reading Skills

1.1.1 Skimming
1.1.2 Scanning
1.1.3 Extensive Reading
1.1.4 Intensive Reading
1.2 Reading Strategies
1.2.1 SQ3R Technique
1.2.2 Reading Efficiently by Reading Intelligently
1.3 Timed Reading Practice
1.3.1 Reading Groups of Words at Each Glance
1.3.2 Reading More Selectively

UNIT-II

2. WRITING AND GRAMMAR

2.1 Writing Letters - Part I
2.1.1 Formal Letters - Part I
2.1.2 Letters of Enquiry
2.1.3 Letters of Complaint and Apology
2.1.4 Letters of Request
2.1.5 Email
2.2 Grammatical Elements
2.2.1 Phrase
2.2.2 Phrasal Verbs
2.2.3 Prepositional Phrasal Verbs
2.2.4 Adverbial Phrasal Verbs

UNIT-III

3. TECHNICAL WRITING PART- I

3.1 Introduction to Technical Writing
3.2 Technical Writing Basics
3.2.1 Structuring Your Writing
3.2.2 Positioning Your Writing
3.2.3 Choosing the Right Words
3.2.4 Avoiding Traps
3.2.5 Making Your Technical Writing More Interesting
3.2.6 The 5 Cs of Technical Writing
3.2.7 Referencing

UNIT-IV

4. Nature and Style of Sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence

4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

TEXT BOOKS/ REFERENCES

1. Laplante, Philip A. Technical Writing: A Practical Guide for Engineers and Scientists. Boca Raton: CRC Press, 2012.
2. Maitland, Iain. Write That Letter. 2nd Ed. New Delhi: Kogan Page, 2009.
3. Abraham, T. C. Effective Letter Writing. New Delhi: Commonwealth, 2009.
4. Terttu Nevalainen and Sanna-Kaisa Tanskanen. Letter Writing. Amsterdam/Philadelphia: John Banjamin's Publishing Company, 2007.
5. Seely John. Oxford Guide to Effective Writing and Speaking. New Delhi: OUP, 2009.
6. Inthira, S.R and V. Saraswathi (1995) Enrich your English Communication Skills Book (Book I) New Delhi: OUP & CIEFL., Hyderabad.
7. Inthira, S.R and V. Saraswathi (1995) Enrich your English: Academic Skills Book (Book II) New Delhi: OUP & CIEFL., Hyderabad.
8. Tickoo, M. L. and et al. Living English Grammar and Composition. Hyderabad: Orient Longman, 1993.
9. Crystal, David. A Little Book of Language. Hyderabad: Orient Blackswan, 2010.
10. Green, David. Contemporary English Grammar Structures and Composition. Delhi: Macmillan, 2011.
11. English Grammar by Wren and Martin
12. Practical English Usage. Michael Swan. OUP. 1995.
13. Remedial English Grammar. F.T. Wood. Macmillan.2007
14. On Writing Well. William Zinsser. Harper Resource Book. 2001
15. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
16. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
17. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

COURSE ASSESSMENT

A. Continuous Assessment: (40%)
B. End Semester Examination (60 %)

CENTRAL UNIVERSITY OF KARNATAKA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

CENTRAL UNIVERSITY OF KARNATAKA

COURSE STRUCTURE AND SYLLABUS

For

3rd and 4th Semester

B.Tech. in ELECTRICAL ENGINEERING

2020 Batch

Learning Outcomes-based Curriculum Framework

(Effective from the academic year 2021 –22)

DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - SECOND YEAR

B.Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2021-22)

III SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEETC30014	CC	Analog Electronics and Instrumentation	3	1	-	4	2.5	30	45	75	3
UEETC30015	CC	Digital Electronics	3	1	-	4	2.5	30	45	75	3
UEETC30016	CC	Network Analysis	3	1	-	4	2.5	30	45	75	3
UEETC30017	CC	Transformers And Generators	3	1	-	4	2.5	30	45	75	3
UEEPC30018	CC	Analog Electronics Lab	-	-	3	3	3	20	30	50	2
UEEPC30019	CC	Digital Electronics Lab	-	-	3	3	3	20	30	50	2
UEEPC30020	CC	Transformers And Generators Lab	-	-	3	3	3	20	30	50	2
UEETG30303	GE	Open Elective-1	2	-	-	2	2	20	30	50	2
		Total	**14**	**4**	**9**	**27**		**200**	**300**	**500**	**20**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses

2.Open Elective-1 Preferably be taken from the elective offered from Mathematics Department or Engineering Mathematics related course from NPTEL/MOOC/SWAYAM

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DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - SECOND YEAR

B.Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2021-22)

IV SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEETC40021	CC	Microprocessor and Microcontroller	3	1	-	4	2.5	30	45	75	3
UEETC40022	CC	Electrical Motors	3	1	-	4	2.5	30	45	75	3
UEETC40023	CC	Electromagnetic Theory	3	1	-	4	2.5	30	45	75	3
UEETC40024	CC	Control systems	3	1	-	4	2.5	30	45	75	3
UEEPC40025	CC	Electrical Motors Lab	-	-	3	3	3	20	30	50	2
UEEPC40026	CC	Microprocessor and Microcontroller Lab	-	-	3	3	3	20	30	50	2
UEEPC40027	CC	Control systems Lab	-	-	3	3	3	20	30	50	2
UEETG40304	GE	Open Elective-2	2	-	-	2	2	20	30	50	2
UEERC40101	CC	Independent Project-I						20	30	50	2
		Total	**14**	**4**	**9**	**27**		**220**	**330**	**550**	**22**

Note: 1. CC-Core Course, DS-Discipline Specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses
2. Open Elective-1 Preferably be taken from the elective offered from Mathematics Department or Engineering Mathematics related course from NPTEL/MOOC/SWAYAM

COURSE CONTENTS

SEMESTER-III

ANALOG ELECTRONICS & INSTRUMENTATION

Semester	**:**	**III**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UEETC30014**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits: 03					

PREREQUSITES

Exposure to Basic Electronics, PN junction diodes, NPN/PNP BJTs.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Analyse the response of BJTs for AC signals.
CO2. Understand the JFETs and apply the knowledge in designing amplifiers.
CO3. Understand the MOSFETs and apply the knowledge in designing amplifiers.
CO4. Apply the basics of positive feedback and design of sinusoidal oscillators.
CO5. Understand basic of instrumentation and transducers.

UNIT-I

BJT AC Analysis: The re transistor model, Common emitter fixed bias, Voltage divider bias, Emitter follower configuration. Darlington connection-DC bias; The Hybrid equivalent model, Approximate Hybrid Equivalent Circuit- Fixed bias, Voltage divider, Emitter follower configuration; Complete Hybrid equivalent model, Hybrid π. **RBT Levels: L1, L2, L3.**

UNIT-II

Field Effect Transistor: Construction and Characteristics of JFETs, Transfer Characteristics, Depletion type MOSFET, Enhancement type MOSFET. FET Amplifiers: JFET small signal model, Fixed bias configuration, Self-bias configuration, Voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration. **RBT Levels: L1, L2, L3, L4.**

UNIT-III

Feedback & Oscillators: Feedback concepts, Feedback connection types, Practical feedback circuits, Oscillator operation, FET Phase shift oscillator, Wein bridge oscillator, Tuned Oscillator circuit, Crystal oscillator, UJT construction, UJT Oscillator. **RBT Levels: L1, L2, L3, L4.**

UNIT-IV

Introduction to Instrumentation: Measurement & Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. Basics of Transducers: Resistive Transducers, Thermistors, LVDT, Photo-Electric Transducers. **RBT Levels: L1, L2.**

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuit Theory*,Pearson, 10th Edition, 2012.

REFERENCE BOOKS

1. J. Millman and A. Grabel, *Microelectronics*, McGraw Hill Education, 1988.
2. A. S. Sedra and K. C. Smith, *Microelectronic Circuits*, New York, Oxford University Press, 1998.
3. Alan S Morris *Measurement and Instrumentation Principles*, Butterworth-Heinemann, 2001.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/105/108105158/
2. https://nptel.ac.in/courses/108/102/108102095/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

DIGITAL ELECTRONICS

Semester	**:**	**III**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UEETC30015**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits: 03					

PREREQUSITES

Basic exposure to electronic circuits, number systems, semiconductor and circuit theory.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand various number systems and their conversion techniques.

CO2. Analyse the logics gates and design of digital ICs using these basic gates.

CO3. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.

CO4. Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.

CO5. Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.

UNIT-I

Fundamentals of Digital Systems and Logic Families: Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic. **RBT Levels: L1, L2, L3.**

UNIT-II

Combinational Digital Circuits: Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization. **RBT Levels: L1, L2, L3, L4.**

UNIT-III

Sequential Circuits & Systems: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and Dtypes flipflops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter ICs, asynchronous sequential counters, applications of counters. channels. **RBT Levels: L1, L2, L3, L4.**

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs algorithm. **RBT Levels: L1, L2, L3, L4.**

TEXT BOOKS

1. R. P. Jain, Modern Digital Electronics, Mc-Graw Hill Education, 2009.
2. M. M. Mano, *Digital Logic and Comupter Design*, Pearson Education India, 2016.

REFERENCE BOOKS

1. Anand Kumar, Fundamentals of Digital Circuits, Pearson Education India, 2016.
2. Digital Fundamentals, Williom Floyd, 11th Edition, Pearson Education India, 2015.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://nptel.ac.in/courses/108/105/108105113/

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **30 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

NETWORK ANALYSIS

Semester	**:**	**III**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UEETC30016**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**2.5**
Credits: 03					

PREREQUSITES

Exposure to Basic Electrical Engineering.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the concept of super node and super mesh.
CO2. Apply the basic electrical concept for analysis of courses.
CO3. Analyze and simplifying network parameters using network theorems.
CO4. Analysis of transient behavior of networks.
CO5. Calculate two port network parameters and their conversion.

UNIT-I

Basic Concepts: Practical sources, Source transformations, Network reduction using Star-Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. **RBT Levels: L1, L2, L3, L4.**

UNIT-II

Network Theorems: Superposition, Reciprocity, Millman's theorems, Thevinin's and Norton's theorems, Maximum Power transfer theorem and Millers Theorem. **RBT Levels: L1, L2, L3, L4.**

UNIT-III

Transient Behavior and Initial Conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations. Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis. **RBT Levels: L1, L2, L3, L4.**

UNIT-IV

Two Port Network Parameters: Definition of z, y, h and transmission parameters, modelling with these parameters, relationship between parameters sets. **RBT Levels: L1, L2.**

TEXT BOOKS

1. William Hayt, J. E. Kemmerly, J. D. Philips and S. M. Durbin, *Engineering Circuit Analysis*, Mc-Graw Hill 9th Edition, 2020.

2. Roy Choudhury, *Networks and Systems*, 2nd Edition, New Age International Publications, 2006.

REFERENCE BOOKS

1. M. E. Van Valkenberg, *Network Analysis*, Prentice Hall of India, 3rd Edition, 2000.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/105/108105159/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

TRANSFORMERS AND GENERATORS

Semester :	**III**	**Internal Assessment** :	**30**
Course Code :	**UEETC30017**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**2.5**
Credits : 03			

PREREQUSITES

Basic Electrical engineering and Engineering Mathematics.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1: Understand the construction and operation of 1-phase, 3-Phase transformers and Autotransformer. Analyze the performance of transformers.

CO2: Understand the three phase transformer connecting and electromagnetic energy conversion.

CO3: Understand the construction and working of AC and DC Generators. Analyze their performance

CO4: Analyze the performance of the AC Generators and determine the performance. Understand basics of DFIG and PMSG.

UNIT-I

Introduction to magnetic circuits and induction.

Single phase Transformers: Ideal transformer**,** operation of practical transformer under no-load and on-load with phasor diagrams. Open circuit and Short circuit tests, calculation of equivalent circuit parameters and predetermination of efficiency-commercial and all-day efficiency. Voltage regulation and its significance.

Three-phase Transformers: Introduction, Constructional features of three-phase transformers. Choice between single unit three-phase transformer and a bank of three single-phase transformers. **RBT Levels: L1-L4**

UNIT-II

Transformer connection for three phase operation. Phase Conversion-Scott connection for three-phase to two-phase conversion. Labelling of three-phase transformer terminals, vector groups**.** Three-winding transformers. Cooling of transformers.
Principles of electromechanical energy conversion. Basic concept of rotating machines
RBT Levels:L1- L3

UNIT-III

Direct current Generator: Construction, magnetic circuit, types of DC generator, characteristics Armature reaction, Commutation and associated problems,

Synchronous Generators: Armature windings, winding factors, e.m.f equation. Harmonics–causes, reduction and elimination. Armature reaction, Synchronous reactance, Equivalent circuit

Alternator on load. Excitation control for constant terminal voltage. Voltage regulation. Open circuit and short circuit characteristics, Assessment of reactance-short circuit ratio, synchronous reactance, Voltage regulation by EMF, MMF and ZPF.

RBT Levels:L1- L4.

UNIT-IV

Synchronous Generators (Salient Pole): Effects of saliency, two-reaction theory, Parallel operation of generators and load sharing. Methods of Synchronization, Synchronizing power, Determination of Xd and Xq,slip test

Performance of Synchronous Generators: Power angle characteristic (salient and non salient pole), power angle diagram, reluctance power, Capability curve for large turbo generators. Hunting and damper windings. Introduction to DFIG and PMSG.**RBT Levels:L1- L4.**

TEXT BOOKS and REFERENCE BOOKS

- Electric Machines I.J. Nagrath and D.P.Kothari, T.M.H. publishing Co. Ltd., New Delhi, 4/e Edition, 2010.
- Principles of Electric Machines and Power Electronics P.C. Sen,Wiley StudentEdition,2 nd edtion,2008.
- Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013
- Electric Machinary Fitzgerald and Kingsley T.M.HEducation(India),Pvt. Ltd., New Delhi, 6th edition
- Electric Machinery Fundamentals, Stephen Chapman T.M.H. publishing 4 th edition
- The Performance and Design of AC machines MG Say, Pit man& Sons.
- Electrical Machinery , P.S Bimbhra , Kanna Publishers
- Electrical Machines, Drives and Power systems, Theodore Wildi, Pearson, 6th Edition, 2014

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

Minimum two test and two assignments shall be given. The course instructor may decide means of evaluation like, mini project, presentation, report writing, surprise test. Appropriate weightage for each type of evaluation may be decided my course instructor.

B. **End Sem Examination** (Weightage **45 Marks**)

The pattern of question paper may be decided by the course instructor. All units shall carry equal weightage.

ANALOG ELECTRONICS LAB

Semester :	**III**	**Internal Assessment :**	**20**
Course Code :	**UEEPC30018**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3.0**
Credits: 02			

PREREQUSITES

Exposure to Analog circuits and basic electronics.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Recognize and demonstrate functioning of semiconductor devices.

CO2. Evaluate the characteristics, switching, and power conversion by semiconductor devices.

CO3. Analyze the response and plot the characteristics of Transducers such as LDR, Photodiode etc.

CO4. Design analog circuits using OPAMPs for different applications.

CO5. Analyze analog circuits that uses ICs for different electronic applications.

LIST OF EXPERIMENTS

1. Conduct experiment to test diode clipping (Single / double ended) and clamping circuits (positive / negative). **RBT Level: L1 to L4**
2. Half-wave rectifier and Full-wave rectifier with and without filter and measure the ripple factor. **RBT Level: L1 to L4**
3. Design a Zener voltage regulator and determine line and load regulation. **RBT Level: L1 to L4**
4. Characteristics of LDR and Photo diode **RBT Level: L1 to L4**
5. Design Adder, Integrator, and Differentiator circuits using Op-Amp **RBT Level: L1 to L4**
6. Design a Schmitt trigger for the given UTP and LTP values and obtain the hysteresis **RBT Level: L1 to L4**
7. Design a 4-bit R – 2R OPAMP Digital to Analog converter using 4-bit binary input. **RBT Level: L1 to L4**
8. Design Monostable and Astable multivibrator using 555 Timer. **RBT Level: L1 to L4**

TEXT BOOKS

1. David A.Bell, - Fundamentals of Electronic Devices and circuits Lab. Manual, 5th Edition, 2009, Oxford University Press.

REFERENCE BOOKS

1. Adel S Sedra, Kenneth S Smith, - Microelectronics Circuits, Theory and Applications, 6th Edition, Oxford, 2015.

2. Ramakanth A Gaekwad, - OPAMPS and Linear integrated Circuits, 4th Edition, Pearson Education, 2000.

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **20 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

DIGITAL ELECTRONICS LAB

Semester :	**III**	**Internal Assessment :**	**20**
Course Code :	**UEEPC20019**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3.0**
Credits: 02			

PREREQUSITES

Exposure to Digital electronics

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Design, Realize and verify DeMorgan's Theorem, SOP, POS forms

CO2. Demonstrate the truth table of various expressions and combinational circuits using logic gates.

CO3. Design various combinational circuits such as adders, subtractors, comparators, multiplexers and demultiplexers.

CO4. Construct Flip-Flops and Counters.

CO5. Construct Shift Registers

LIST OF EXPERIMENTS

1. Verify i) DeMorgan's Theorem for 2 variables ii) The sum-of-product and product-of-sum expressions using universal gates. **RBT Level: L1 to L4**
2. Design and implement i) Half-adder and Full-adder using a) Basic gates b) NAND Gates
   ii) Half-substractor and Full-substractor using a) Basic gates and NAND gates. **RBT Level: L1 to L4**
3. Design and implementation of i) 1 bit comparator ii) 5-bit magnitude comparator using IC 7485. Ii) BCD to excess conversion and vice-versa. **RBT Level: L1 to L4**
4. Design and implement i) 4-bit parallel adder/subtractor using IC 7483. **RBT Level: L1 to L4**
5. Realize i) Adder and subtractor using IC 74153 ii) 4 Variable function using IC 74151 (8:1MUX) RBT **Level: L1 to L4**
6. Realize i) Adder and Subtractor using IC 74139 ii) Binary to Gray code conversion and vice-versa using 74139. **RBT Level: L1 to L4**
7. Realize the following flip-flops using NAND gates: Master-Slave J K, D and T Flip-Flops **RBT Level: L1 to L4**
8. Realize the following shift registers using IC 7474 / 7495: i) Ring ii) Johnson counter.
9. Realize i) Design Mod-N Synchronous Up counter and Down counter using 7476 JK Flip-Flop ii) Mod-N counter using IC 7490 / 7476. **RBT Level: L1 to L4**
10. Design Pseudo Random Sequence generator using 7495. **RBT Level: L1 to L4**

TEXT BOOKS

1. D. P Kothari and J.S. Dhillon, - Digital circuits and Design, Pearson, 2016

REFERENCE BOOKS

1. Morris Mono, -. Digital Design, Prentice Hall of India, 3rd Edition.

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **20 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

TRANSFORMERS AND GENERATORS LAB

Semester :	**III**	**Internal Assessment :**	**20**
Course Code :	**UEEPC20020**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3**
Credits : 02			

PREREQUSITES

Basics of Transformer and Generators.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Evaluate the performance of transformers from the test data.

CO2. Illustrate the performance of two single phase transformers of different KVA rating in parallel. Analyse the single phase transformers for three phase operation and phase conversion. Conduct polarity test on transformer

CO3. Compute the voltage regulation of synchronous generator by different methods

CO4. Conduct slip test, draw the power angle curve and evaluate the performance of Synchronous generators.

LIST OF EXPERIMENTS

1. Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit. **RBT Level: L1-L4**
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency. **RBT Level:L1- L3**
3. Separation of hysteresis and eddy current losses in single phase transformer **RBT Level: L1-L3**
4. Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load. **RBT Level:L1- L3**
5. Scott connection with balanced and unbalanced loads. **RBT Level: L1-L3**
6. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load. **RBT Level: L1-L3**
7. Voltage regulation of an alternator by ZPF method. **RBT Level:L1- L3**
8. Voltage regulation of an alternator by EMF and MMF methods. **RBT Level:L1- L4**

9. Power angle curve of synchronous generator or Direct load test on three phase synchronous generator to determine efficiency and regulation. **RBT Level:L1- L4**
10. Slip test – Measurement of direct and quadrature axis reactance and predetermination of regulation of salient pole synchronous machines. **RBT Level: L1- L4**
11. Performance of synchronous generator connected to infinite bus, under constant power and variable excitation & vice - versa. **RBT Level:L1- L4**

TEXT BOOKS and REFERENCE BOOKS

- Electric Machines, I.J. Nagrath and D.P.Kothari, T.M.H. publishing Co. Ltd., New Delhi, 4/e Edition, 2010.
- Principles of Electric Machines and Power Electronics P.C. Sen, Wiley StudentEdition,2 nd edtion,2008.
- Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous assessments will be based on regular experiment conduction, record submission and test and viva-voce on regular intervals.

B. **End Sem Examination** (Weightage **30 Marks**)

An experiment will be assigned, same will be evaluated by write up, conduction and viva-voce

Note: Due to pandemic situation, if unable conduct physical labs. The experiments may be conducted on software platforms wherever possible.

SEMESTER-IV

MICROPROCESSOR AND MICROCONTROLLER

Semester	**:**	**IV**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UEETC40021**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hourse)**	**:**	**2.5**
Credits: 03					

PREREQUSITES

Digital electronics, Basic computer operations and number system

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Develop a clear understanding of microprocessor, machine and assembly language.
CO2. Describe the architecture and functional block of 8085/8085 microprocessors.
CO3. Describe the architecture details of 8051 and Atmega328 microcontroller.
CO4. Develop an application using 8051 for the given specification.
CO5. Develop an application using Atmega328 microcontroller for the given specification.

UNIT-I

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU

Introduction to Microprocessors: Definition, Need and evolution of microprocessors.

Core of programming: Concept of machine language and assembly language. Building our own machine and assembly language. **RBT Levels: L1, L2.**

UNIT-II

Microprocessors:

Intel 8085: Features of 8085, Architecture, Pin diagram, Memory, Addressing modes and instructions.

Intel 8086: Features of 8086, Architecture, Pin diagram, Memory and Programming.

RBT Levels: L1, L2, L3.

UNIT-III

Microcontrollers:

Intel 8051: Features of 8051, Architecture, Pin diagram, Ports, Internal Memory and Addressing modes. Interrupts, Timers and Counters of 8051. Instructions of Programming 8051.

RBT Levels: L1, L2, L3, L4.

UNIT-IV

Advanced Microcontrollers:

AVR Microcontrollers: Introduction to AVR, Architecture, Pin Configuration, Registers, Addressing modes, Ports and DDR register and control operations, Programming with AVR.

Application development using Microcontrollers: **RBT Levels: L1, L2 L3, L4.**

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing.
2. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
3. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010
4. Advanced microprocessors and peripherals-A. K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.

REFERENCE BOOKS

1. Muhammad Ali Mazidi , Janice Gillispie Mazidi and Rolin D McKinlay, The 8051 microcontroller and embedded systems using assembly and C, second edition Pearson education Asia
2. Mohamed Rafiquzzaman, Microprocessor and Microcomputer based system design, second edition, CRC press.
3. Danny Causey, Muhammad Ali Mazidi, and Rolin D. McKinlay, PIC Microcontroller and Embedded SystemsUsing Assembly and. C for PIC18. Pearson 2008.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108/105/108105102/
2. https://nptel.ac.in/courses/117/104/117104072/

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **30 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage
- **Remaining 10 marks** will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

ELECTROMAGNETIC THEORY

Semester :	**IV**	**Internal Assessment :**	**30**
Course Code :	**UEETC40022**	**End Sem. Exam :**	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours) :**	**2.5**
Credits: 03			

PREREQUSITES

Exposure to Physics and Vector calculus.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Evaluate problems on electrostatic force by applying conventional methods.

CO2. Apply Gauss's law to evaluate electric fields by different charge distributions.

CO3. Determine potential and energy with respect to point charge and capacitance using Laplaces equation and Apply Biot-Savart and Ampere's law for evaluating magnetic field.

CO4. Calculate magnetic force, potential energy and magnetization with respect to magnetic materials.

CO5. Apply Maxwell's equations for time-varying fields and evaluate power associated in EM waves.

UNIT-I

Coulomb's Law and Electric Field Intensity: Experimental Law of Coulomb, Electric Field Intensity, Field due to continuous volume charge distribution, Field of a line chsrge, Numerical Problems.

Flux Density, Gauss's Law and Divergence: Electric Flux density, Gauss's Law, Application to Gauss;s Law to point charge, line charge, surface charge and volume charge, point form of Gauss law and divergence. Maxwelle;s first equation, Vector operator del and divergence Theorem, Numerical problems. **RBT Levels: L1, L2, L3.**

UNIT-II

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field. The line integral, definition of potential difference and potential, potential field of a point charge, potential gradient, numerical problems. Current and current density, continuity of current.

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem. **RBT Levels: L1, L2, L3.**

UNIT-III

Steady Magnetic Field: Biot-Savert Law, Ameere's Circuital Law, Curl, Stokes' theorem, magnetic flux and magnetic flux density, basic concepts of scalar and vector magnetic potentials, numerical problems,

Magnetic forces: Force on a moving charge, Differential current elements, Force between differential current elements. Magnetisation and permeability, Magnetic boundary conditions, The magnetic circuit, **Potential** energy and forces on magnetic materials, inductance and mutual reactance

RBT Levels: L1, L2, L3.

UNIT-IV

Faraday's law of Electromagnetic induction: Integral form and differential form, Displacement current, Conduction current, Maxwell's equations integral form and differential form.

Uniform Plane Wave: Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric. Wave propagation in free space, wave propagation in good conductor, skim depth or depth of penetration. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. W. H. Hayt and J.A. Buck, - Engineering Electromagnetics, 8th Edition, Tata McGraw Hill, 2014, ISBN-978-93-392-0327-6.

REFERENCE BOOKS

1. Mathew N.O., Sadiku, - Elements of Electromagnetics, Oxford Press University, 4th Edition
2. N. Narayana Rao, - Fundamentals of Electromagnetics for Engineering, Pearson

ONLINE RESOURCES

1. https://ocw.mit.edu
2. https://nptel.ac.in

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **30 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage
- Remaining 10 marks will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

CONTROL SYSTEMS

Semester :	**IV**	**Internal Assessment** :	**30**
Course Code :	**UEETC40023**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**2.5**
Credits: 03			

PREREQUSITES

Exposure to various mathematical modelling and time and frequency domain transforms.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Develop the mathematical model of Mechanical and Electrical systems.

CO2. Determine transfer function for a given control system using block diagram reduction techniques and signal flow graph method.

CO3. Analyze the time domain specifications for first and second order systems.

CO4. Illustrate the stability of a system in the time domain using Routh-Hurwitz criterion.

CO5. Evaluate the stability of a system in the frequency domain using Nyquist and Bode plots.

UNIT-I

Introduction: Types of control system, Effect of feedback system, Differential equation of physical systems –Mechanical systems, Electrical systems, Electromechanical systems, Analogous systems.

RBT Levels: L1, L2, L3.

UNIT-II

Block diagrams and Signal flow graphs: Transfer functions, Block diagram algebra and signal flow graphs

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. **RBT Levels: L1, L2, L3.**

UNIT-III

Time response specifications: Time response specifications of second order systems, steady state errors and error constants, Introduction to PI, PD and PID controllers (Excluding design).

Stability Analysis: Concept of stability, necessary conditions for stability, Routh stability criterion, Introduction to Root-Locus Techniques, the root locus concepts, construction of root locus. **RBT Levels: L1, L2, L3.**

UNIT-IV

Frequency domain analysis and Stability: Correlation between time and frequency response, Bode plots, Experimental determination of transfer function. Introduction to lead, lag and lead-lag compensating network (excluding design).

Introduction to state variable analysis: Concept of state, state variable and state models for electrical systems, solution of state equations. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. J. Nagarath and M. Gopal, - Control System Engineering, New Age International (P) Limited, Publishers, Fifth Edition – 2005, ISBN: 81-224-2008-7.

REFERENCE BOOKS

1. Benjamin, C. Kuo -Automatic Control Systems, John Wily India PVT. Ltd., 8th Edition, 2008.
2. K. Ogata, - Modern Control Engineering, Pearson Education Asia / PHI, 4th Edition, 2002,

ONLINE RESOURCES

1. www.teoma.co.uk
2. https://ieeexplore.ieee.org

COURSE ASSESSMENT

A. **Continuous Assessment (**Weightage **30 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage
- Remaining 10 marks will be given for Assignments (Four Assignments will be given with one each from respective units).

B. **End Sem Examination** (Weightage **45 Marks**)

- One full question carries 11/12 Marks. Full question may be divided further into sub questions.
- There will be two full questions from each unit and a total of EIGHT FULL QUESTIONS.
- Student has to answer FOUR FULL QUESTIONS one from each unit i.e., Answering one full question from each unit is mandatory.

ELECTRICAL MOTORS

Semester :	**IV**	**Internal Assessment** :	**30**
Course Code :	**UEETC40024**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**2.5**
Credits : 03			

PREREQUSITES

Basic Electrical engineering and Engineering Mathematics.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the construction, operation and classification of DC Motor, AC motor and Special purpose motors.

CO2. Illustrate the performance characteristics & applications of Electric motors.

CO3. Explore the methods of testing of DC machines and determine losses and efficiency. Understand speed control of Control the speed of DC motor and induction motor

CO4. Understand operation, control and analyze the performance of synchronous motor.

UNIT-I

DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters. Losses and Efficiency- Losses in DC motors, power flow diagram, efficiency, condition for maximum efficiency.

Testing of DC Motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests.

RBT Levels: L1-L4

UNIT-II

Single-Phase Induction Motor: Double revolving field theory and principle of operation. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors. Comparison of single. phase motors and applications.

Three Phase Induction Motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip- Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation, Maximum torque, significance of slip. **RBT Levels: L1- L3**

UNIT-III

Performance of Three-Phase Induction Motor: Phasor diagram of induction motor on no-load and on load, equivalent circuit, losses, efficiency, No-load and blocked rotor tests. Performance of the motor from the circle diagram and equivalent circuit. Cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and

performance evaluation of double cage induction motor. Induction motor working as induction generator. **RBT Levels: L1-L4.**

UNIT-IV

Starting and Speed Control of Three-Phase Induction Motors: Need for starter. Direct on line, Star-Delta and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods.

Synchronous Motor: Principle of operation, phasor diagrams, torque and torque angle, Blondel diagram, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors.

Introduction to Universal motor, AC servomotor, Linear induction motor, stepper motors and reluctance motors. **RBT Levels: L1-L4**

TEXT BOOKS and REFERENCE BOOKS

- Electric Machines I.J. Nagrath and D.P.Kothari, T.M.H. publishing Co. Ltd., New Delhi, 4/e Edition, 2010.
- Principles of Electric Machines and Power Electronics P.C. Sen,Wiley StudentEdition,2 nd edtion,2008.
- Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013
- Electric Machinary Fitzgerald and Kingsley T.M.HEducation(India),Pvt. Ltd., New Delhi, 6th edition
- Electric Machinery Fundamentals, Stephen Chapman T.M.H. publishing 4 th edition
- The Performance and Design of AC machines MG Say, Pit man& Sons.
- Electrical Machinery , P.S Bimbhra , Kanna Publishers
- Electrical Machines, Drives and Power systems, Theodore Wildi, Pearson, 6th Edition, 2014

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

Minimum two test and two assignments shall be given. The course instructor may decide means of evaluation like, mini project, presentation, report writing, surprise test. Appropriate weightage for each type of evaluation may be decided my course instructor.

B. **End Sem Examination** (Weightage **45 Marks**)

The pattern of question paper may be decided by the course instructor. All units shall carry equal weightage.

MICROPROCESSOR AND MICROCONTROLLER LAB

Semester :	**IV**	**Internal Assessment :**	**20**
Course Code :	**UEEPC40025**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3**
Credits: 02			

PREREQUSITES

Microprocessor and Microcontroller theoretical concepts

COURSE OUTCOMES

On the completion of this laboratory course, the students will be able to:

CO1. Implement assembly language programs for 8085 and 8051.
CO2. Interfacing and testing various interface various IO devices with 8051.
CO3. Interfacing and testing various interface various IO devices with Atmega328P.
CO4. Interfacing and testing various interface various IO devices with Arduino platform

8085 / 8086 Assembly programming: RBT Levels: L1, L2, L3, L4.

1. Basic arithmetic and Logical operations
2. Various addressing modes
3. Data movements programs
4. Code conversion (decimal, binary, octal and hex).
5. Floating point operations, string manipulations, sorting and searching
6. Subroutines and ISRs

8051 Assembly Programming: RBT Levels: L1, L2, L3, L4.

1. Basic arithmetic and Logical operations
2. Bit addressable operations (Internal Memory)
3. Code conversion, decimal arithmetic and Matrix operations.
4. Counters and Time Delay
5. Subroutines and ISRs
6. Interfacing IO devices (Switches, LEDs)

Assembly Programming AVR: RBT Levels: L1, L2, L3, L4.

1. Basics data Operations
2. Various addressing modes
3. Counters and Time Delay
4. Subroutines and ISRs
5. Interfacing IO devices (Switches, LEDs)
6. Mixing C and Assembly

TEXT BOOKS

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, 6th Edition, Penram International Publishing.
2. D.V.Hall, Microprocessors and Interfacing. TMGH, 2nd edition 2006.
3. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010
4. Muhammad Ali Mazidi , Janice Gillispie Mazidi and Rolin D McKinlay, The 8051 microcontroller and embedded systems using assembly and C, second edition Pearson education Asia

COURSE ASSESSMENT

A. **Continuous Assessment (**Weightage **20 Marks)**

- Two continuous assessments will be conducted with each one of 10 marks weightage

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part) 15 marks will be given and remaining 15 will be given for performing the experiment and showing the output.

CONTROL SYSTEMS LAB

Semester	**:**	**IV**	**Internal Assessment**	**:**	**20**
Course Code	**:**	**UEEPC40026**	**End Sem. Exam**	**:**	**30**
Teaching Hours/Week (L:T:P)	**:**	**0:0:3**	**Exam Duration (Hours)**	**:**	**3.0**
Credits : 02					

PREREQUSITES

Exposure to Basic Control Systems course and Engineering Mathematics.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.

CO2. Analyze and simulate Lead, Lag and Lag – Lead compensators for given specifications.

CO3. Illustrate the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair used in control systems.

CO4. Apply the DC position and feedback control system to study the effect of P, PI, PD and PID controller and Lead compensator on the step response of the system.

CO5. Interpret the plots of Root locus, Bode and Nyquist for stability studies.

LIST OF EXPERIMENTS

1.	Experiment to draw the speed torque characteristics of (i) AC servo motor (ii) DC servo motor. **RBT Level: L1 to L4**
2.	Experiment to draw synchro-pair characteristics. **RBT Level: L1 to L4**
3.	Experiment to determine frequency response of a second order system. **RBT Level: L1 to L4**
4.	To design a passive RC lead compensating network for the given specifications, viz, the maximum phase lead and the frequency at which it occurs and to obtain the frequency response. **RBT Level: L1 to L4**
5.	To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response. **RBT Level: L1 to L4**
6.	Experiment to draw the frequency response characteristics of the lag – lead compensator network and determination of its transfer function. **RBT Level: L1 to L4**
7.	To study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response. **RBT Level: L1 to L4**
8.	(a) To simulate a typical second order system and determine step response and evaluate time response specifications. (b) To evaluate the effect of adding poles and zeros on time response of second order system. (c) To evaluate the effect of pole location on stability.**RBT Level: L1 to L4**

9.	(a) To simulate a D.C. Position control system and obtain its step response. (b) To verify the effect of input waveform, loop gain and system type on steady state (c) To perform trade-off study for lead compensator. (d) To design PI controller and study its effect on steady state error. **RBT Level: L1 to L4**
10.	(a) To examine the relationship between open-loop frequency response and stability, open-loop frequency and closed loop transient response. (b) To study the effect of open loop gain on transient response of closed loop system using root locus.**RBT Level: L1 to L4**
11.	(a) To study the effect of open loop poles and zeros on root locus contour (b) Comparative study of Bode, Nyquist and root locus with respect to stability. **RBT Level: L1 to L4**

TEXT BOOKS

1. J. Nagarath and M. Gopal, - Control System Engineering, New Age International (P) Limited, Publishers, Fifth Edition – 2005, ISBN: 81-224-2008-7.

REFERENCE BOOKS

1. Benjamin, C. Kuo -Automatic Control Systems, John Wily India PVT. Ltd., 8th Edition, 2008.
2. K. Ogata, - Modern Control Engineering, Pearson Education Asia / PHI, 4th Edition, 2002.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

Continuous assessments will be based regular experiment conduction, record submission and test and viva-voce on regular intervals.

B. **End Sem Examination** (Weightage **30 Marks**)

- An experiment will be allotted and the same has to be designed and performed by the student. For designing (theory part), performing the experiment and showing the output marks will be distributed.

Note: Due to pandemic situation, if unable conduct physical labs. The experiments may be conducted on software platforms wherever possible.

ELECTRICAL MOTORS LAB

Semester :	**IV**	**Internal Assessment :**	**20**
Course Code :	**UEEPC40027**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3**
Credits : 02			

PREREQUSITES

Knowledge of DC and AC motors.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Conduct test on DC motor to determine their characteristics and control the speed of DC Motor.

CO2. Evaluate the performance characteristics of DC machines by conducting suitable tests.

CO3. Perform test on single phase and three phase induction motor evaluate their performance and predetermine the performance characteristics.

CO4. Conduct experiment on synchronous motor to draw the performance curves.

LIST OF EXPERIMENTS

1. Load test on DC shunt motor to draw speed–torque and horse power–efficiency characteristics. **RBT Level: L1-L4**
2. Speed control of DC shunt motor by armature and field control. **RBT Level:L1- L3**
3. Field Test on DC series machines. **RBT Level:L1- L3**
4. Retardation test on DC shunt motor. **RBT Level:L1- L3**
5. Swinburne's Test on DC motor. **RBT Level: L1-L3**
6. Load test on three phase induction motor. **RBT Level: L1-L3**

7. No-load and Blocked rotor test on three phase induction motor to draw (i) Equivalent circuit. (ii) Circle diagram. Determination of performance parameters at different load conditions **RBT Level: L1-L4**

8. Load test on single phase induction motor to draw output versus torque, current, power and efficiency characteristics. **RBT Level: L1-L4**

9. Conduct suitable tests to draw thee equivalent circuit of single phase induction motor and determine performance parameters. **RBT Level:L1- L4**

10. Conduct an experiment to draw v and Inverted v curves of synchronous motor at no load and load conditions. **RBT Level: L1-L4**

TEXT BOOKS and REFERENCE BOOKS

- Electric Machines I.J. Nagrath and D.P.Kothari, T.M.H. publishing Co. Ltd., New Delhi, 4/e Edition, 2010.
- Principles of Electric Machines and Power Electronics P.C. Sen,Wiley StudentEdition,2 nd edtion,2008.
- Electric Machines, Ashfaq Hussain, Dhanpat Rai & Co, 2nd Edition, 2013

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous assessments will be based regular experiment conduction, record submission and test and viva-voce on regular intervals.

B. **End Sem Examination** (Weightage **30 Marks**)

An experiment will be assigned, same will be evaluated by write up, conduction and viva-voce.

Note: Due to pandemic situation, if unable conduct physical labs. The experiments may be conducted on software platforms wherever possible.

CENTRAL UNIVERSITY OF KARNATAKA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

CENTRAL UNIVERSITY OF KARNATAKA

COURSE STRUCTURE AND SYLLABUS

For

5th to 8th Semester

B. Tech. in ELECTRICAL ENGINEERING

2020 Batch

Learning **O**utcomes-based **C**urriculum **F**ramework

(Effective from the academic year 2020 –21)

DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - THIRD YEAR- FIFTH SEMESTER

B. Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

V SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEETC50028	CC	Power Generation and Transmission	3	1	-	4	2	30	45	75	3
UEETC50029	CC	Power Electronics	3	1	-	4	2	30	45	75	3
UEETC50030	CC	Power System Analysis-I	3	1	-	4	2	30	45	75	3
UEETC50031	CC	Advanced Signal Processing	3	1	-	4	2	30	45	75	3
UEETC50032	CC	Power Electronics Lab	-	-	3	3	3	20	30	50	2
UEETC50033	CC	Advanced Signal Processing Lab	-	-	3	3	3	20	30	50	2
UEETC50034	CC	Machine Learning Lab	1	-	2	3	3	20	30	50	2
UEETD50201	DS	DSE-1	3	-	-	3	2	30	45	75	3
		Total	**16**	**4**	**8**	**28**		**210**	**315**	**525**	**21**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses
2. Discipline Specific Elective (DSE)- should be selected from the respective groups only.

DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - THIRD YEAR- SIXTH SEMESTER

B. Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

VI SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEETC60035	CC	Power System Analysis-II	3	1	-	4	2	30	45	75	3
UEETC60036	CC	Power System Protection	3	1	-	4	2	30	45	75	3
UEETC60037	CC	Electric Drives and Applications	3	1	-	4	2	30	45	75	3
UEECC60038	CC	Design and Drawing of Electrical systems	1	1	2	4	3	30	45	75	3
UEETC60039	CC	Electric Drives Lab	-	-	3	3	3	20	30	50	2
UEEPC60040	CC	Power Systems Lab	-	-	3	3	3	20	30	50	2
UEEPC60041	CC	Internet of Things (IOT) Lab	1	-	2	3	3	20	30	50	2
UEETD60202	DS	DSE-2	3	-	-	3	2	30	45	75	3
UEERC60042	CC	Minor Project						20	30	50	2
		Total	**14**	**4**	**10**	**28**		**230**	**345**	**575**	**23**

Note: 1. CC-Core Course, DS-Discipline Specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses.
2. Discipline Specific Elective (DSE)- should be selected from the respective groups only.

DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - FOURTH YEAR-SEVENTH SEMESTER

B.Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

VII SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEETC70043	CC	Power System Operation and Control	3	1	-	4	2	30	45	75	3
UEETC70044	CC	High Voltage Generation and Measurement	3	1	-	4	2	30	45	75	3
UEETD70203	DE	DSE-3	3	-	-	3	2	30	45	75	3
UEETD70204	DE	DSE-4	3	-	-	3	2	30	45	75	3
UEEPC70045	CC	Power System Protection Lab	-	-	3	3	3	20	30	50	2
UEEPC70046	CC	Renewable Energy Lab	-	-	3	3	3	20	30	50	2
UEERC70047	CC	Major Project- Phase- I	-	-	2	2	--	20	30	50	2
UEEIA70101	DE	Internship	-	-	-	-	3	20	30	50	2
		Total	**12**	**2**	**8**	**22**		**200**	**300**	**500**	**20**

Note: 1. CC-Core Course, DS-Discipline specific Elective, AE-Ability Enhancement course and GE-Generic Elective courses.
2. Discipline Specific Elective (DSE)- should be selected from the respective groups only.

DEPARTMENT OF ELECTRICAL ENGINEERING

COURSE STRUCTURE - FOURTH YEAR-EIGHTH SEMESTER

B.Tech. in ELECTRICAL ENGINEERING

(Effective from the academic year 2020-21)

VIII SEMESTER											
Course Code	**Course Type**	**Course Title**	**Teaching Hrs./Week**				**Examination**				**Credits**
			Theory/ Lecture	**Tutorial**	**Practical/ Drawing**	**Total**	**Duration in Hrs.**	**IA Marks**	**End Sem Marks**	**Total Marks**	
			L	**T**	**P**						
UEERA80048	CC	Technical Writing and Presentation	-	-	-	-	-	20	30	50	2
UEERC80049	CC	Major Project Phase-II	-	-	-	-	-	160	240	400	16
		Total				**-**		**180**	**270**	**450**	**18**

List of Discipline Specific Electives (DSE) for Semesters 5th and 6th

Note: The DSE subjects will be added to the respective groups as per the availability of the faculty and expertise.

Subjects of DSE-1 Group	Subjects of DSE-2 Group
1. Optimization Techniques. 2. Modern Control Theory. 3. Special Electrical Machines. 4. Managerial Economics. 5. Electricity Act and Regulations. 6. Engineering Materials	1. Electrical Estimation and Costing. 2. Electrical Measurement and Instrumentation. 3. Energy Auditing. 4. Power System Planning. 5. Power system communication.

List of Discipline Specific Electives (DSE) for Semester 7th

Subjects of DSE-3 Group	Subjects of DSE-4 Group
1. Renewable Energy Sources. 2. Solar and Wind Energy Systems. 3. Testing and Commissioning. 4. Electrical Vehicles. 5. Power system estimation and costing. 6. Power Quality. 7. Distribution Systems Design and Control. 8. Energy Storage Management.	1. Power system Reliability. 2. Power system dynamics. 3. Digital Control of Power Electronics. 4. AI Applications to Power Systems. 5. Big Data and Cloud Computing Applications to Smart Grids. 6. DG and Micro Grid 7. Smart Grid

CENTRAL UNIVERSITY OF KARNATAKA	**Central University of Karnataka** (Established by an Act of the Parliament in 2009) School of Engineering	**Dept.: EE Dept.** **Curriculum** **Syllabus Contents** **w.e.f. 2020-21**

POWER GENERATION AND TRANSMISSION

Semester	**:**	**V**	**Internal Assessment**	**:**	**30**
Course Code	**:**	**UEETC50028**	**End Sem. Exam**	**:**	**45**
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**	**Exam Duration (Hours)**	**:**	**02**
Credits : 03					

PREREQUSITES

Basic exposure to electric circuit analysis and Laws of Electricity generation.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the working principles of different electric power generation plants.
CO2. Illustrate the economics of power generation.
CO3. Computation of sag in the transmission lines.
CO4. Analyze the transmission lines and its performance parameters.

UNIT-I

Introduction to different sources for electric power generation: Hydroelectric power plants: merits and demerits of hydroelectric power plants, selection of site. General arrangement of hydel plant, classification. Steam Power Plants: Introduction, working of steam plant. **RBT Levels: L1, L2.**

UNIT-II

Power Plants: Diesel power palnt, introduction, operation and applications. Gas Turbine Power Plant: Introduction, operation and applications. Nuclear Power Plant: Introduction, operation and control. **Economics of Generation:** Introduction, definitions of connected load, maximum demand, demand factor, load factor and diversity factor. **RBT Levels: L1, L2.**

UNIT-III

Overhead Line Insulators and Insulated Cables: Introduction, types of insulators, potential distribution over a string of suspension insulators, insulating materials, grading of cables, insulation resistance of a cable, capacitance of cables. Overhead lines versus underground cables. Sag calculation. **RBT Levels: L1, L2, L3.**

UNIT-IV

Inductance and Capacitance Calculations of Transmission Lines: Inductance and capacitance of transmission lines, composite conductors, bundled conductors, classification of transmission lines, performance of transmission lines. Corona: Introduction and disadvantages of corona.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. "Power Plant Engineering" P.K. Nag McGraw Hill 4th Edition, 2014.
2. "Generation of Electrical Energy" B. R. Gupta S. Chand 2015.
3. "Electrical power Generation, Transmission and Distribution" S.N. Singh PHI 2nd Edition, 2009.

REFERENCE BOOKS

1. A Course in Power Systems" J. B. Gupta, Katson 2008.
2. "A Text Book on Power System Engineering" A. Chakrabarti, et al Dhanpath Rai 2nd Edition, 2010.
3. Wadhwa, "Electrical Power system", Wiley Eastern Ltd. 2005.
4. A. Chakrabarti, ML. Soni, P.V. Gupta, V.S. Bhatnagar, "A text book of Power system Engineering" Dhanpat Rai, 2000.

ONLINE RESOURCES

1. https://nptel.ac.in/courses
2. https://mnre.gov.in/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

POWER ELECTRONICS

Semester	**: V**	**Internal Assessment**	**: 30**
Course Code	**: UEETC50029**	**End Sem. Exam**	**: 45**
Teaching Hours/Week (L:T:P)	**: 3:1:0**	**Exam Duration (Hours)**	**: 02**
Credits: 03			

PREREQUSITES

Basic exposure to semiconductor devices, diodes and transistors.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the basics of Power Electronics and types of converters.

CO2. Illustrate the characteristics and operation power semiconductor switching devices.

CO3. Analyze the various power converters.

CO4. Examine the different aspects of power converters under various loads.

UNIT-I

Introduction: Applications of Power Electronics, Types of Power Electronic Circuits, Peripheral Effects.

Power devices: Diodes, SCRs, GTO, BJT, MOSFET, IGBT- Characteristics, working, selection and protection, driver circuits.

RBT Levels: L1, L2, L3.

UNIT-II

Controlled Rectifiers: Introduction, Single-Phase Full Converters with R. R-L load, Single-Phase Dual Converters, Three- Phase Full Converters.

DC-DC Converters: Introduction, principle of step down and step-up chopper with RL load, performance parameters, DC-DC converter classification, Switched mode regulators.

RBT Levels: L1, L2, L3, L4

UNIT-III

DC-AC converters: Introduction, principle and operation of single phase, three inverters. PWM techniques, Voltage source inverters and Current source inverters.

RBT Levels: L1, L2, L3, L4.

UNIT-IV

AC-AC Converters: Phase Controller (AC Voltage Regulator)-Introduction, principle of operation of single-phase voltage controllers for R, R-L loads and its applications. Cyclo-converter Principle of operation of single phase cyclo-converters, circulating current mode of operation.

RBT Levels: L1, L2, L3, L4

TEXT BOOKS

1. Muhammad H. Rashid, “Power Electronics - circuits, devices and applications”, Prentice Hall of India, 2nd edition.
2. Ned Mohan, Tore M. Undeland, ‘Power electronics: converters, applications, and design’, John Wiley &Sons.,3 rd edition.

REFERENCE BOOKS

1. Power Electronics – Devices, Converters and Applications”, by Vedam Subramanyam Revised 2nd edition, New Age Publications.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
3. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
4. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108101038
2. https://nptel.ac.in/courses/108101126

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

POWER SYSTEM ANALYSIS-I

Semester :	**V**	**Internal Assessment** :	**30**
Course Code :	**UEETC50030**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits: 03			

PREREQUSITES

Basic exposure to Electrical Engineering and network analysis.

COURSE OBJECTIVES

After completing this Course, the students will be able to:

CO1. Introduce the per unit system and analyze power system using per unit system.

CO2. Compute three phase symmetrical fault current on synchronous machine and simple power systems.

CO3. Illustrate symmetrical components, their advantages to power system.

CO4. Analyze unsymmetrical faults using symmetrical components of synchronous machine and simple power systems.

UNIT-I

Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of electrical Power, Representation of Loads.

RBT Levels: L1, L2, L3, L4.

UNIT-II

Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine (On No Load), Short Circuit of a Loaded Synchronous Machine, Selection of Circuit Breakers.

RBT Levels: L1, L2, L3, L4.

UNIT-III

Symmetrical Components: Introduction, Symmetrical Component Transformation, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System.

RBT Levels: L1, L2, L3, L4.

UNIT-IV

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. V.Neelkantan, “Power System Analysis and Stability”.
2. Nagoor Kani. “Power System Analysis”. Khanna Publication.

REFERENCE BOOKS

1. Modern Power System, D. P. Kothari, McGraw Hill, 2018.
2. Power System Analysis, Hadi Sadat, McGraw Hill. 2011

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108105067

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

ADVANCED SIGNAL PROCESSING

Semester :	**V**	**Internal Assessment** :	**30**
Course Code :	**UEETC50031**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits: 03			

PREREQUSITES

Basic exposure to Laplace and Z transforms.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Explain and solve Discrete time systems.

CO2. Analysis of discrete time systems using various transform techniques.

CO3. Apply DFT and IDFT for filtering and computing the given sequence.

CO4. Design and Realization of digital Filters.

UNIT-I

Introduction: Overview of Discrete time signals and a system, Analysis of discrete-time linear time invariant systems, Multirate signal processing, Z-transform and Inverse of Z-transform, Digital filter structures.

RBT Levels: L1, L2, L3.

UNIT-II

Frequency domain analysis: Discrete Fourier transform (DFT), Inverse DFT, Inter relationship with z-transform and Hilbert-transforms, Discrete Hilbert transform, FFT algorithms Decimation in time and decimation in frequency. Spectral analysis using DFT, Short term DFT.

RBT Levels: L1, L2, L3.

UNIT-III

Design of IIR Digital Filters: Design of digital Chebyshev –type 1filter by impulse invariant transformation and bilinear transformation, Frequency transformations. Realization of IIR digital systems: direct form, cascade form and parallel form, Ladder structures for equal degree polynomial.

RBT Levels: L1, L2, L3.

UNIT-IV

Design of FIR Digital Filters: Design of FIR digital filters by use of windows, Design of FIR digital filters-frequency sampling techniques. Realization of FIR systems: direct form, cascade form, linear phase form.

Introduction to DSP processor: Types of architectures.

RBT Levels: L1, L2, L3.

TEXT BOOKS

1. John G. Proakis, Dimitris G. Mamalakis, Digital Signal Processing, Principles, Algorithms and Applications.
2. Jhonny R. Jhonson Pearson 1 st Edition, 2016, Introduction to Digital Signal Processing
3. Signals and Systems Simon Haykin, Berry Van Veen Wiley 2 nd Edition,2002

REFERENCE BOOKS

1. Antonious, Digital Filter Design, Mc-Graw-Hill International Editions.
2. S. Salivahanan C Gnanapriya, Digital Signal Processing, Tata McGraw Hill Education Private Limited.
3. A. Nagoor Kani, Digital Signal Processing, McGraw Hill Education Private Limited.
4. 2. Alan V. Oppenheim Ronald W. Schafer, Digital Signal Processing, PHI, India.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/117101001
2. https://ieeexplore.ieee.org

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

POWER ELECTRONICS LAB

Semester :	**V**	**Internal Assessment** :	**30**
Course Code :	**UEEPC50032**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours)** :	**02**
Credits: 02			

PREREQUSITES

Basic exposure to Power Electronics and Converters.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Demonstrate the experiment to plot static characteristics of semiconductor devices.
CO2. Verify the performance of various types of power electronic converters.
CO3. Perform speed control of a DC motor and universal motor.
CO4. Analyze the Simulation model of Power Electronics circuit.

LIST OF EXPERIMENTS

1	Static Characteristics of SCR, MOSFET and IGBT.
2	SCR turn on circuit using synchronized UJT relaxation oscillator.
3	AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
4	Single phase controlled full wave rectifier with R and R –L loads.
5	Speed control of universal motor using ac voltage regulator.
6	Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
7	Single Phase Bridge inverter with R and RL loads
8	Simulation of Buck and Boost chopper
9	Simulation of single-phase Inverter with PWM control.
10	Simulation of three phase fully controlled converter with R and RL loads, with and without freewheeling diode.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. Muhammad H. Rashid , “Power Electronics - circuits, devices and applications”, Prentice Hall of India, 2nd edition.
2. Ned Mohan, Tore M. Undeland, ‘Power electronics: converters, applications, and design’, John Wiley &Sons., 3rd edition.

REFERENCE BOOKS

1. Power Electronics – Devices, Converters and Applications", by Vedam Subramanyam Revised 2nd edition, New Age Publications.
2. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

ADVANCED SIGNAL PROCESSING LAB

Semester :	**V**	**Internal Assessment** :	**30**
Course Code :	**UEEPC50033**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours)** :	**02**
Credits: 02			

PREREQUSITES

Basic exposure to signals and digital filters.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the mathematical operation on discrete signals.
CO2. Analyze the response of DFT and IDFT of the signal.
CO3. Compute linear and circular convolution of discrete sequences.
CO4. Design and implement IIR and FIR filter using different techniques.

LIST OF EXPERIMENTS

	PART A - LIST OF EXPERIMENTS USING MATLAB
1.	To find DFT / IDFT of given DT signal.
2.	Program to obtain Linear and Circular Convolution of two finite length sequences
3.	To find frequency response of a given system(transfer function/ difference equation)
4.	Implementation of FFT of given sequence.
5.	Determination of Power Spectrum of a given signal.
6.	Implementation of LP and HP FIR filter for a given sequence.
7.	Generation of Sinusoidal signal through filtering.
8.	Implementation of Decimation Process.
9.	Implementation of Interpolation Process.
10.	Implementation of I/D sampling rate converters.
11.	Implementation of LP and HP IIR filter for a given sequence.
12.	Impulse Response of First Order and Second Order Systems.
	ADDITIONAL EXPERIMENT
1.	Demonstration of DSP processor.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

3. Digital Signal Processing Principles, Algorithms, and Applications John G. Proakis, Prentice-Hall International. Inc, 4th Edition, 2012.

4. Theory and Application of Digital Signal Processing by Lawrence R.Rabiner and Bernard Gold

REFERENCE BOOKS

1. Oppenheim, Alan V. Discrete-time signal processing. Pearson Education India, 1999.
2. Mitra, Sanjit Kumar, and Yonghong Kuo. Digital signal processing: a computer-based approach. Vol. 2. New York: McGraw-Hill Higher Education, 2006.

A. COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

MACHINE LEARNING (ML) LAB

Semester :	**V**	**Internal Assessment** :	**20**
Course Code :	**UEEPC50034**	**End Sem. Exam** :	**30**
Teaching Hours/Week (L:T:P) :	**1:0:2**	**Exam Duration (Hours)** :	**03**
Credits: 02			

PREREQUSITES

Basic exposure to Software Programming.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the mathematical and statistical prospective of machine learning algorithms.
CO2. Apply various data preprocessing techniques and visualization.
CO3. Design and develop the supervised and unsupervised ML models.
CO4. Identify and apply Machine Learning algorithms to solve real world problems.

LIST OF EXPERIMENTS

1. Write a program to compute
   a. Central Tendency Measures: Mean, Median and Mode
   b. Measure of Dispersion: Variance and Standard Deviation.
   RBT Levels: L1, L2, L3, L4.

2. Write a program to implement the following data preprocessing techniques.
   a. Filling the missing values in the dataset
   b. Normalization
   c. Standardization
   d. Binarization

   RBT Levels: L1, L2, L3, L4.

3. Write a program to implement the below data visualization techniques using matplotlib library.
   a. plotting the line
   b. bar chart
   c. scatter plot
   d. pie chart
   RBT Levels: L1, L2, L3, L4.
4. Write a program to implement the linear regression model. (use python ML library).
   RBT Levels: L1, L2, L3, L4.

5. Write a program to implement the Naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets. (use python ML library)
   RBT Levels: L1, L2, L3, L4.

6. Write a program to implement the K-Nearest Neighbor (K-NN) algorithm to classify the IRIS dataset. Compute the accuracy of the classifier considering 80:20 split ratio and print the correct and wrong predictions using Confusion matrix. (use python ML library)
   RBT Levels: L1, L2, L3, L4.

7. Write a Python program to implement the K-NN classifier without using the python ML libraries. Following features should be implemented in this program.
   a. Create your own dataset containing 10 rows and 3 columns. First two columns represent the input features which can take any real values and last column represents the class label which can take either 0 or 1 (Example of an instance: 8.67, -0.24,1)
   b. Consider K value as 3 (i.e, no of nearest neighbors)

   Build the K-NN classifier model using 70:30 split ratio with 70% data as training data. Test the accuracy of the model using remaining 30% data. Use the Euclidian distance as the similarity measure. **RBT Levels: L1, L2, L3, L4.**

8. Write a program to implement the K-Means clustering algorithm.
   RBT Levels: L1, L2, L3, L4.

REFERENCE BOOKS

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education, (INDIAN EDITION), 2013.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, h The Elements of Statistical Learning, 2nd edition, springer series in statistics.
3. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, 1st Edition, O’Reilly Media, 2016.
4. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, 2019

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

POWER SYSTEM ANALYSIS-II

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UEETC60035**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits: 03			

PREREQUSITES

Basic exposure to Electrical Engineering and Power System analysis.

COURSE OUTCOMES

After completing this course, the students will be able to:

CO1. Apply graph theory for modeling of power system and compute various incidence matrices.

CO2. Deduce Z bus by building algorithm and carry out load flow analysis of power system using iterative approach.

CO3. Perform economic generation scheduling of thermal power plants.

CO4. Comprehend Power System stability using various techniques.

UNIT-I

Network Topology: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop analysis, Formation of Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation without Mutual Coupling. Y bus by Inspection Method without Mutual Coupling.

RBT Levels: L1, L2.L3, L4.

UNIT-II

Load Flow Studies: Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow. Gauss Seidal iterative method, Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LFS methods and Numerical on Load flow studies. Comparison of Load Flow Methods.

RBT Levels: L1, L2, L3, L4.

UNIT-III

Economic Operation of Power System: Introduction and Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation scheduling including generator limits and neglecting losses, Economic dispatch including transmission losses, Derivation of transmission loss formula.

RBT Levels: L1, L2, L3, L4.

UNIT-IV

Power System Stability: Introduction, Classification, Power angle Equation, Swing Equation, Equal area criterion. **RBT Levels: L1, L2, L3, L4.**

TEXT BOOKS

1. "Computer Methods in Power Systems Analysis", Glenn W Stagg Ahmed H Ei - Abiad McGraw Hill 1st Edition.
2. "Computer Techniques and Models in Power systems", K. Uma Rao. IK Publishers.

REFERENCE BOOKS

1. Modern Power System, D. P. Kothari, McGraw Hill,2018.
2. Power System Analysis, Hadi Sadat, McGraw Hill.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108105067

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

POWER SYSTEM PROTECTION

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UEETC60036**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits : 03			

PREREQUSITES

Basics of power system analysis, motor, generators, transmission, distribution and signal processing.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the need of power system protection
CO2. Analyze operation of circuit breaker
CO3. Analyze different aspects of relaying
CO4. Understand over voltage protection

UNIT-I

Introduction to Power System Protection: Need for protective schemes, Nature and Cause of Faults, Types of Faults, Effects of Faults. Power system components. Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection**.**

RBT Levels: L1, L2,L3.

UNIT-II

Circuit Breakers: Introduction Arc phenomenon and interruption of arc, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air-Break Circuit Breakers, Oil Circuit Breakers, Air-Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers. Advancement in circuit breakers.

RBT Levels: L1, L2, L3,L4.

UNIT-III

Relays: Classification of relays, Introduction to EM relays, static relays. Numerical relays, phasor estimation, WAMP and PMU. Overcurrent protection, distance protection, unit protection. Advancement in protective relays**.**

RBT Levels: L1, L2, L3.

UNIT-IV

Protection against Over voltage: Causes of over voltages, Introduction to lightning phenomena. Insulation Coordination, Basic Impulse Insulation Level (BIL). Methods of over voltage protection. Modern Trends in Power System Protection: Introduction, gas insulated substation/switchgear (GIS)**.**

RBT Levels: L1, L2, L3.

REFERENCE BOOKS

1. Badri Ram, D. N. Vishwakarma Power System Protection and Switchgear McGraw Hill 2nd Edition..
2. S. S. Rao, Switchgear and Protection, Khanna Publishers..
3. Arun G. Phadke, James S. Thorp, Computer Relaying for Power Systems, Wiley..
4. Y. G. Paithankar and S R Bhide, Fundamentals of Power System Protection, Prentice Hall of India..
5. Allan Thomas Johns, S.K. Salman, Digital Protection for Power Systems, The Institution of Engineering and Technology.
6. A. G. Phadke, J.S. Thorp, Synchronized Phasor Measurements and Their Applications, Springer

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108105167

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

ELECTRIC DRIVES AND APPLICATIONS

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UEETC60037**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits : 03			

PREREQUSITES

Basic exposure to Power Electronics, machines and its applications.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand the basic aspects of electric drives and its applications.
CO2. Illustrate the selection of motor power ratings and control of dc motor.
CO3. Analyze the performance and control of DC motor drives.
CO4. Analyze the performance and control of AC drives.

UNIT-I

Electrical Drives: Electrical Drives, Choice of Electrical Drives, Status of DC and AC Drives.
Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques.
RBT Levels: L1, L2, L3.

UNIT-II

Direct Current Motor Drives: Controlled Rectifier Fed DC Drives, Single Phase and Three phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Multi-quadrant Operation of DC Separately Excited Motor, Chopper Control of DC Motor.
RBT Levels: L1, L2, L3, L4

UNIT-III

Induction Motor Drives: Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control. Voltage Source Inverter (VSI) Control, Closed Loop Speed Control, Variable Frequency Control. Current Source Inverter (CSI) Control.
RBT Levels: L1, L2, L3, L4

UNIT-IV

Synchronous Motor Drives: Synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Permanent Magnet AC (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives.
RBT Levels: L1, L2, L3, L4

TEXT BOOKS

1. Fundamentals of Electrical Drives, Gopal K. Dubey, Narosa Publishing, 2nd Edition, 2001.
2. Electrical Drives: Concepts and Applications, Vedum Subrahmanyam, McGraw Hill, 2nd Edition, 2011.

REFERENCE BOOKS

1. Electric Drives N.K De,P.K. Sen PHI Learning 1st Edition, 2009
2. Bimal K Bose, “Modern Power Electronics and AC Drives” PHI
3. R. Krishnan, “Electric motor drives: modeling, analysis and control, Pearson.

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108104140

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

DESIGN AND DRAWING OF ELECTRICAL SYSTEMS

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UEECC60038**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**1:1:2**	**Exam Duration (Hours)** :	**03**
Credits: 03			

PREREQUSITES

Basic exposure to Electrical systems designing like SLD, Windings calculations etc.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand design factors, considerations and limitations of Electrical Systems.
CO2. Design and sketch the layout of electrical wiring and substation.
CO3. Develop the armature-winding diagram for DC and AC machines.
CO4. Design and construct sectional views of transformers, assembled DC and AC machine and their parts.

UNIT-I

Introduction to software's: understanding the working of software's for design and drawing.
Electrical Wiring layout: design and drawing of wiring layout of residential, commercial and electrical laboratories.
RBT Levels: L1, L2, L3, L4

UNIT-II

DC and AC Machines: Factors and considerations in design, Design and construct sectional views of assembled DC machine and synchronous machine, design and develop a winding diagram of DC and AC machines.
RBT Levels: L1, L2, L3, L4

UNIT-III

Single line diagrams: Design and sketch the single line diagram of generating stations and substations for a given specifications.
RBT Levels: L1, L2, L3, L4

UNIT-IV

Transformers: Factors and considerations in design, Estimation of Number of Turns and Conductor Cross Sectional area of Windings, Design and construct sectional views of core and shell type transformers.
RBT Levels: L1, L2, L3, L4

TEXT BOOKS

1. A course in Electrical Machine design, A. K. Sawhney, DhanpatRai, 6th Edition, 2013

REFERENCE BOOKS

1. Performance and Design of Alternating Current Machines, M.G. Say, CBS Publisher, 3rd Edition, 2002.
2. Design Data Handbook, A. Sanmugasundaram Et al, New Age International, 1st Edition, 2011
3. Electrical Engineering Drawing K. L. Narang Satya Prakashan 2014

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108102146

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

ELECTRICAL DRIVES LAB

Semester :	**VI**	**Internal Assessment** :	**30**
Course Code :	**UEEPC60039**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours)** :	**02**
Credits: 02			

PREREQUSITES

Basic exposure to Power Electronics and Electrical drives.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Perform the speed control of motors using various converters.

CO1. Verify the performance of various types of power electronic converters.

CO2. Perform the speed control of a motors using processors.

CO3. Develop and Simulate the various Power Electronics circuit models.

LIST OF EXPERIMENTS

1.	Speed control of Converter fed DC motor.
2.	Speed control of Chopper fed DC motor.
3.	V/f control of three-phase induction motor.
4.	Micro controller-based speed control of Stepper motor.
5.	Speed control of BLDC motor.
6.	DSP based speed control of SRM motor.
7.	Speed and position control of servo motor by DSP controller.
8.	Single phase Multi Level Inverter based induction motor drive.
9.	VSI/CSI fed induction motor drive analysis using software.
10.	Regenerative/ Dynamic breaking operation for DC motor study using software.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. Fundamentals of Electrical Drives, Gopal K. Dubey, Narosa Publishing, 2nd Edition, 2001.
2. Electrical Drives: Concepts and Applications, Vedum Subrahmanyam, McGraw Hill, 2nd Edition, 2011.

REFERENCE BOOKS

1. Electric Drives N. K De, P.K. Sen PHI Learning 1st Edition, 2009
2. Bimal K Bose, “Modern Power Electronics and AC Drives” PHI
3. R. Krishnan, “Electric motor drives: modeling, analysis and control, Pearson.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

POWER SYSTEMS LAB

Semester :	**VI**	**Internal Assessment :**	**20**
Course Code :	**UEEPC60040**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**03**
Credits: 02			

PREREQUSITES

Basic exposure to Power system analysis and Software.

COURSE OBJECTIVES

After completing this Course, the students should be able to:

CO1. Determine power angle characteristics of synchronous machines and transmission line performance.

CO2. Compute various network matrices using different techniques.

CO3. Perform power system load flow study and Economic Scheduling of Generators.

CO4. Analyze power system faults and stability studies.

LIST OF EXPERIMENTS

1.	Formation for symmetric π /T configuration for Verification of $AD-BC$=1, Determination of Efficiency and Regulation. **RBT Level: L1,L2,L3,L4**
2.	Determination of Power Angle Diagrams, Reluctance Power, Excitation, Emf and Regulation for Salient and Non-Salient Pole Synchronous Machines. **RBT Level: L1,L2,L3,L4**
3.	To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault on One of the two Lines. **RBT Level: L1,L2,L3,L4**
4.	Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation and Inspection Method. RBT Level: L1 to L4
5.	Formation of Z Bus (without mutual coupling) using Z-Bus Building Algorithm. **RBT Level: L1,L2,L3,L4**
6.	Determination of Bus Currents, Bus Power and Line Flow for a Specified System Voltage (Bus) Profile. **RBT Level: L1,L2,L3,L4**
7.	Formation of Jacobian for a System not Exceeding 4 Buses (No PV Buses) in Polar Coordinates. **RBT Level: L1,L2,L3,L4**

8.	Load Flow Analysis using Gauss Siedel Method, NR Method and Fast Decoupled Method for Both PQ and PV Buses. **RBT Level: L1,L2,L3,L4**
9.	To Determine Fault Currents and Voltages in a Single Transmission Line System with Star-Delta Transformers at a Specified Location for LG and LLG faults by simulation. **RBT Level: L1,L2,L3,L4**
10.	Optimal Generation Scheduling for Thermal power plants by simulation. **RBT Level: L1,L2,L3,L4**

TEXT BOOKS

1. Power System Analysis, Hadi Sadat, McGraw Hill.

REFERENCE BOOKS

1. Modern Power System, D. P. Kothari, McGraw Hill,2018.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

Internet of Things (IOT) LAB

Semester :	**VI**	**Internal Assessment :**	**20**
Course Code :	**UEECC60041**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**1:0:2**	**Exam Duration (Hours) :**	**03**
Credits: 02			

PREREQUSITES

Basic exposure to Interfacing of Electronics, Sensors and Software.

COURSE OUTCOMES

After completing this course, the students should be able to:

CO1. Understand the basic concepts of IoT system.

CO2. Design and development of necessary hardware and software for IoT system.

CO3. Employ advanced level knowledge, techniques, skills and modern tools for the IoT system.

CO4. Illustrate different sensor technologies for sensing real world entities.

LIST OF EXPERIMENTS

1. Hardware and Software for IoT: **RBT Levels: L1, L2, L3, L4**.
    1. Familiarization with concept of IoT, Arduino/ Raspberry Pi and perform software installation.
    2. Study of different operating systems for Arduino/Raspberry-Pi.
    3. Understanding the process of OS installation on Arduino/Raspberry-Pi.
2. Working with AVR / Arduino: **RBT Levels: L1, L2, L3, L4**
    1. To implement an Arduino based simple digital I/O system.
    2. To implement analog output from the Arduino board in the form of Pulse Width Modulation.
    3. Interface a SSD and LCD with Arduino board.
    4. Interfacing Sensors with Arduino (Temperature, IR etc sensor).
    5. Interfacing Motors with Arduino (Stepper or DC OR Servo).
    6. Interface a heat sensor to the Arduino board and display its reading on an LCD.
    7. Use the external interrupts of the Arduino board.
3. Working with Raspberry-Pi: **RBT Levels: L1, L2, L3, L4.**
    1. Study of Connectivity and configuration of Raspberry-Pi board with basic peripherals, LEDS.
    2. Understanding GPIO and its use in program.
    3. Interfacing Sensors with Raspberry-Pi (Temperature, IR etc sensor).
    4. Use the X-Bee module to understand the connectivity of Raspberry-Pi board with camera. Write an application to capture and store the image.
    5. Interfacing Motors with Raspberry-Pi (Stepper or DC OR Servo)
    6. Write a server application to be deployed on Raspberry-Pi board. Write client applications to get services from the server application.
    7. Understanding of the Raspberry Pi with Cloud Interfacing

TEXT BOOKS

1. Arshdeep Bahga, and Vijay Madisetti, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2013.
4. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1.

ONLINE RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs17/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

MINOR PROJECT

Semester :	**VI**	**Internal Assessment** :	**20**
Course Code :	**UEERC60042**	**End Sem. Exam** :	**30**
Teaching Hours/Week (L:T:P) :	**0:0:0**	**Exam Duration (Hours)** :	**3**
Credits: 02			

PREREQUSITES

Working knowledge of Electrical Engineering areas including basics of Computer Science.

COURSE OUTCOMES

After completing the minor project, the students should be able to:

CO1. Construct working models and explore field independently.
CO2. Devise system integration skills.
CO3. Demonstrate documentation skills.
CO4. Develop Project management skills.

GUIDELINES

There shall be an UG Minor-project under the guidance of one of the department faculties of their specialization. Students will register for this immediately after V semester. The UG mini-project shall be submitted in a report form and presented before the committee in VI semester. The following points need be followed for UG Minor project:

1. Student has to select a project either of their own interest or in consultation with faculty members of the department.
2. Students should carry out the mini project independently/group.
3. If student has his/her own idea for an individual Project, it is the student's responsibility to find a faculty member who both approves of the proposed Programme of work and is willing to be the supervisor.
4. It is the responsibility of the student to update the progress of the work to the concerned supervisor regularly.
5. Students must submit the brief report with minimum 10 pages (printed on double side) at the end of the semester in the following format.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:

  -Title of the Project: 24, Bold.

  -Main/Chapter Header (1, 2, etc..): 16, Bold.

-Sub title: 14, Bold

-Running Text: 12, Regular

-Lines Spacing: 1.5 Lines

-Paragraph Beginning: 0pt (No Space)

-Paragraph Spacing: 6pt

-Figure Caption (Below Figure, Centre Justified)): 10, Regular Times New Roman

-Table Caption (Above Table, Centre Justified): 10, Regular Times New Roman

-References must be placed at the end of Report

-References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.

COURSE ASSESSMENT

1. **Continuous Assessment** (Weightage **20 Marks**)
   - Continues assessment will be done at a regular interval of time.
2. **End Sem Examination** (Weightage **30 Marks**)
   - The evaluation shall be based on the report submitted and a viva-voce exam.

POWER SYSTEM OPERATION AND CONTROL

Semester	**:**	**VII**		**Internal Assessment**	**:**	**30**	
Course Code	**:**	**UEETC70043**		**End Sem. Exam**	**:**	**45**	
Teaching Hours/Week (L:T:P)	**:**	**3:1:0**		**Exam Duration (Hourse)**	**:**	**2**	
Credits : 03							

PREREQUSITES

Basics of Power system, Control Systems and Signal processing.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Understand power system operation and control.
CO2. Analyze economic operation and active power control.
CO3. Interpret the relation between the reactive power and voltage control.
CO4. Articulate the power system state estimation and contingency analysis.

UNIT-I

Introduction: Operating States of Power System, Objectives of Control, Key Concepts of Reliable Operation, Preventive and Emergency Controls, Load dispatch center, Restructuring of power system. Introduction to modeling of power system components.

RBT Levels: L1, L2,L3.

UNIT-II

Economic operation of power systems: Economic load dispatch, unit commitment. Automatic Generation Control, Modeling of Automatic Load Frequency Control, Interconnected systems.

RBT Levels: L1, L2, L3,L4.

UNIT-III

Voltage and Reactive Power Control: Introduction, Production and Absorption of Reactive Power, Methods of Voltage Control, Dependence of Voltage on Reactive Power, Sensitivity of Voltage to Changes in P And Q, Cost Saving, Methods of Voltage Control

RBT Levels: L1, L2, L3.

UNIT-IV

Operation of single area. Introduction to multi-area systems. Introduction to contingency analysis. State estimation: Importance of state estimation. SCADA and EMS functions. Load forecasting**.**

RBT Levels: L1, L2, L3.

REFERENCE BOOKS

1. C L. Wadhwa, Electrical Power Systems, 3rd Edn, New Age International Publishing Co., 2001.S. S. Rao, Switchgear and Protection, Khanna Publishers..
2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th Edn, Tata McGraw Hill Education Private Limited 2011.
3. D. P. Kothari: Modern Power System Analysis-Tata Mc Graw Hill Pub. Co.
4. Hadi Sadat: Power System Analysis –Tata Mc Graw Hill Pub. Co. 2002
5. B.M. Weedy, B.J. Cory et al," Electric Power systems" Wiley 2012
6. K. Bhattacharya, H. J. Bollen, J. E. Daalder Operation of Restructured Power Systems

ONLINE RESOURCES

1. https://nptel.ac.in/courses/108104052

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

HIGH VOLTAGE GENERATION AND MEASUREMENT

Semester :	**VII**	**Internal Assessment** :	**30**
Course Code :	**UEETC70044**	**End Sem. Exam** :	**45**
Teaching Hours/Week (L:T:P) :	**3:1:0**	**Exam Duration (Hours)** :	**02**
Credits: 03			

PREREQUSITES

Basic exposure to Power Systems, Transmission system and Material Science.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Describe the working principle of generation of high voltages and currents.
CO2. Illustrate the generation of impulse voltage and impulse currents.
CO3. Analyze the measure of high DC and AC voltages.
CO4. Analyze the measure of impulse voltages and currents.

UNIT-I

Generation of high voltages and currents: Direct Voltages: AC to DC conversion methods, electrostatic generators – Cascaded Voltage Multipliers. Alternating Voltages: Testing transformers – Resonant circuits and their applications. **RBT Levels: L1, L2.**

UNIT-II

Impulse voltages and currents: Impulse voltage specifications, Impulse generation circuits – Operation, construction and design of Impulse generators. Impulse Currents: Generation of high impulse currents and high current pulses. **RBT Levels: L1, L2.**

UNIT-III

Measurement of high DC voltages and currents: Series resistance meters, voltage dividers and generating voltmeters. Measurement of high AC Voltages: Series impedance meters, electrostatic voltmeters, potential transformers, voltage dividers and their applications. **RBT Levels: L1, L2, L3.**

UNIT-IV

Measurement of impulse voltage and currents: Voltage dividers and impulse measuring systems, generalized voltage measuring circuits, compensated dividers. Measurement of Impulse Currents: Resistive shunts, current transformers, Hall Generators and Faraday generators, Impulse Oscilloscopes. **RBT Levels: L1, L2, L3.**

TEXT BOOKS

1. "Electrical power Generation, Transmission and Distribution" S.N. Singh PHI 2nd Edition, 2009.
2. High Voltage Engineering E Kuffel and W.S. Zaengl. Pergamon press, Canada Ltd., 1984.

3. High Voltage Engineering- M. S. Naidu and V. Kamaraju, Tata McGraw Hill Book Co., New Delhi, 3rd edition 2004.
4. Wadhwa C L., "High Voltage Engineering", Wiley Eastern Limited, New Delhi, 1994.
5. High Voltage Technology – LL Alston, Oxford University press, 1968.

REFERENCE BOOKS

1. High voltage Measuring Techniques – A Schwab, MIT press Cambridge, USA 1972.
2. High Voltage Engineering – Sabeer Ray.

ONLINE RESOURCES

1. https:nptel.ac.in/courses/108/104/108104013/

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **30 Marks**)

- Two internal assessment tests, assignments, quiz, surprise test, projects, seminars, report etc.… will be conducted. Appropriate marks weightage will be given as per the decision of concern faculty.

B. **End Sem Examination** (Weightage **45 Marks**)

- End semester examination will be conducted by giving proper weightage for all units as per decision of concern faculty.

POWER SYSTEM PROTECTION LAB

Semester :	**VII**	**Internal Assessment :**	**20**
Course Code :	**UEEPC70045**	**End Sem. Exam :**	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours) :**	**3**
Credits : 02			

PREREQUSITES

Basics of power system analysis, motor, generators, transmission and distribution.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Conduct test on CT and MCB and draw the characteristics

CO2. Conduct experiment on relays and draw the characteristics

CO3. Perform test on feeder, transformer transmission line and machine and calculate the performance parameters

CO4. Demonstrate the working of protective relays and schemes

List of Experiments

1	Obtain Characteristics of C.T. Saturation
2	Obtain Characteristic of Miniature Circuit Breaker (MCB) and Fuse.
3	Conduct an Experiment on electromechanical Relays.
4	Conduct an Experiment on Feeder Protection.
5	Conduct an Experiment on static/digital relay.
6	Conduct an Experiment on Transformer protection.
7	Conduct an Experiment on Transmission line performance and protection.
8	Conduct an Experiment on Motor/generator Protection.
9	Conduct an Experiment on Modelling of protection relay/scheme.
10	Demonstration on HIL experiments.

RBT Level: L1, L2, L3, L4

REFERENCE BOOKS

1. Badri Ram, D. N. Vishwakarma Power System Protection and Switchgear McGraw Hill 2nd Edition..
2. S. S. Rao, Switchgear and Protection, Khanna Publishers..

3. Arun G. Phadke, James S. Thorp, Computer Relaying for Power Systems, Wiley..
4. Power System Protection and Switchgear Bhuvanesh Oza et al McGraw Hill 1st Edition, 2010
5. Y. G. Paithankar and S R Bhide, Fundamentals of Power System Protection, Prentice Hall of India.
6. A Web Course on Digital protection of power system by Prof. Dr. S. A. Soman, IIT Bombay.
7. Masson Art And Science of Protective Relaying – Blackburn Protection of power systems

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty

B. **End Sem Examination** (Weightage **30 Marks**)

• As per the question paper given in the end semester examination, the student has to perform and execute the experiment.

• The weightage of the marks will be awarded as per the decision of the concern faculty.

RENEWABLE ENERGY LAB

Semester :	**VII**	**Internal Assessment** :	**20**
Course Code :	**UEEPC70046**	**End Sem. Exam** :	**30**
Teaching Hours/Week (L:T:P) :	**0:0:3**	**Exam Duration (Hours)** :	**03**
Credits: 02			

PREREQUSITES

Basic exposure to electric generators, power systems and power electronics.

COURSE OUTCOMES

After completing this laboratory course, the students should be able to:

CO1. Understand the different sources for power generation.
CO2. Generalize the PV cell characteristics.
CO3. Analyze the operation of wind mills.
CO4. Analyze the PMSG and IG for power generation.

LIST OF EXPERIMENTS

Exp. No.	Experiment Name
1.	Study on potential and characteristics of Renewable Energy Sources.
2.	Study on maximum power point tracking (MPPT) of photovoltaic (PV) Systems.
3.	Study on the power-voltage (P-V) and current-voltage (I-V) characteristics of photovoltaic (PV) Cell.
4.	Wind systems characteristics.
5.	Performance study of PV systems under different conditions.
6.	Study on of photovoltaic (PV) systems: a) Series operation. b) Parallel operation.
7.	Study of wind turbine driven permanent magnet synchronous generator (PMSG) system for grid applications.
8.	Study of hydro turbine/constant speed driven induction generator (IG) system for off-grid applications.
9.	Design of wind turbine driven induction generator (IG) system for grid applications.
10.	Design of three-phase and single-phase inverter.

RBT Levels: L1, L2, L3, L4.

TEXT BOOKS

1. Muhammad H. Rashid, “Power Electronics - circuits, devices and applications”, Prentice Hall of India, 2nd edition.
2. S. C. Bhatia, R. K. Gupta, “Textbook of Renewable Energy”, Woodhead Publishing India PVT. Limited, 2019.
3. Mehmet Kanoglu , Yunus A. Cengel, John M. Cimbala, “Fundamentals and Applications of Renewable Energy”, Indian Edition, MC Graw Hill, 2020.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continuous evaluation of the record book and proper marks will be awarded.
- Internal assessment test will be conducted and appropriate weightage of marks will be awarded as per the decision of the concern faculty.

B. **End Sem Examination** (Weightage **30 Marks**)

- As per the question paper given in the end semester examination, the student has to perform and execute the experiment.
- The weightage of the marks will be awarded as per the decision of the concern faculty.

MAJOR PROJECT PHASE-1

Semester	**:**	**VII**		**Internal Assessment**	**:**	**20**	
Course Code	**:**	**UEERC70047**		**End Sem. Exam**	**:**	**30**	
Teaching Hours/Week (L:T:P)	**:**	**0:0:2**		**Exam Duration (Hours)**	**:**	**3**	
Credits: 02							

PREREQUSITES

Working knowledge of Electrical Engineering areas including basics of Computer Science.

COURSE OUTCOMES

After completing the major project phase-1, the students should be able to:

CO1. Identify problems in real world.
CO2. Develop project management skills.
CO3. Development of problem-solving methodologies.
CO4. Demonstrate documentation skills.

GUIDELINES

There shall be an UG major-project to be chosen in consultation with the department faculties of their specialization. Students will register for the project at the time of commencement of VII semester. The UG major-project shall be submitted in a report form. The following points need be considered for UG Major Project Phase-1

a. Student has to select a project either of their own interest or in consultation with faculty members of the department.
b. Students are advised to carry out project independently, however depending on the complexity of the proposed idea, they can do in group consisting of not more than three, with appropriate permission from Supervisor/Coordinator and HOD.
c. It is the responsibility of the student to report the progress of the work regularly to the concerned supervisor. A proper documentation has to be maintained in this regard.
d. In this phase student is expected to complete the literature review and should define the problem statement to implement the project in the subsequent semester.
e. A report must be submitted to the department.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold.
  -Main/Chapter Header (1, 2, etc..): 16, Bold.
  -Sub title: 14, Bold

-Running Text: 12, Regular
-Lines Spacing: 1.5 Lines
-Paragraph Beginning: 0pt (No Space)
-Paragraph Spacing: 6pt
-Figure Caption (Below Figure, Centre Justified)): 10, Regular Times New Roman
-Table Caption (Above Table, Centre Justified): 10, Regular Times New Roman
-References must be placed at the end of Report
-References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **20 Marks**)

- Continues assessment is carried out by internal supervisor/Guide.
- Project assessment will be carried out in a regular interval.

B. **End Sem Examination** (Weightage **30 Marks**)

- The evaluation shall be based on the report submitted and a viva-voce exam.

INTERNSHIP

Semester	**:**	**VII**		**Internal Assessment**	**:**	**20**	
Course Code	**:**	**UEEIA70101**		**End Sem. Exam**	**:**	**30**	
Teaching Hours/Week (L:T:P)	**:**	**0:0:0**		**Exam Duration (Hours)**	**:**	**03**	
Credits: 02							

PREREQUSITES

Working knowledge of Electrical Engineering areas including basics of Computer Science.

COURSE OUTCOMES

After completing the summer internship, the students should be able to:

CO1. Understand the eco-system of practical implementation.
CO2. Explore the field aspects as per the industrial standards
CO3. Develop the hands-on and real-time working skills
CO4. Demonstrate problem solving skills.

GUIDELINES

There shall be summer internship of two weeks to four weeks duration, in collaboration with an Industry/ educational institute of national repute of their specialization. Students will register for this immediately after the completion of VI semester examinations. The UG summer internship shall be submitted and viva-voce examination will be conducted. The following points need be followed for UG summer internship.

1. Student has to apply the summer internship in consultation with faculty advisor or coordinator/head of the department.
2. Approval from the department is mandatory for applying the summer internship.
3. Students must maintain all records while undergoing the internship like ideas, results, and analysis.
4. Some photographs need to be included in the report to support your internship work.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold.
  -Main/Chapter Header (1, 2, etc..): 16, Bold.
  -Sub title: 14, Bold
  -Running Text: 12, Regular
  -Lines Spacing: 1.5 Lines

-Paragraph Beginning: 0pt (No Space)
-Paragraph Spacing: 6pt
-Figure Caption (Below Figure, Centre Justified)): 10, Regular Times New Roman
-Table Caption (Above Table, Centre Justified): 10, Regular Times New Roman
-References must be placed at the end of Report
-References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.

- Report must be tested against Plagiarism.

COURSE ASSESSMENT

At the end of summer internship course, department will conduct viva-voce examination and presentation by the student.

TECHNICAL WRITING AND PRESENTATION

Semester :	**VIII**	**Internal Assessment** :	**20**
Course Code :	**UEERA80048**	**End Sem. Exam** :	**30**
Teaching Hours/Week (L:T:P) :	**0:0:0**	**Exam Duration (Hours)** :	**03**
Credits: 02			

PREREQUSITES

Technical writing knowledge and writing literature of Electrical Engineering areas.

COURSE OUTCOMES

After completing this Course, the students should be able to:

CO1. Demonstrate the presentation skills.

CO2. Develop the technical writing skills.

GUIDELINES

1. Identify advanced latest technologies or research topic.
2. Carrying literature survey on the same topic.
3. Preparation and submission of technical report on the same topic.
4. Delivering a seminar on the same topic.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold.
  -Main/Chapter Header (1, 2, etc..): 16, Bold.
  -Sub title: 14, Bold
  -Running Text: 12, Regular
  -Lines Spacing: 1.5 Lines
  -Paragraph Beginning: 0pt (No Space)
  -Paragraph Spacing: 6pt
  -Figure Caption (Below Figure, Centre Justified)): 10, Regular Times New Roman
  -Table Caption (Above Table, Centre Justified): 10, Regular Times New Roman
  -References must be placed at the end of Report
  -References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.
- Report must be tested against Plagiarism.

COURSE ASSESSMENT

A. Continuous Assessment (Weightage **20 Marks**)
   • Presentation assessment will be carried out.
B. End Sem Examination (Weightage **30 Marks**)
   • The evaluation shall be based on the report submitted and a viva-voce exam.

MAJOR PROJECT PHASE-2

Semester	**:**	**VIII**		**Internal Assessment**	**:**	**160**	
Course Code	**:**	**UEERC80049**		**End Sem. Exam**	**:**	**240**	
Teaching Hours/Week (L:T:P)	**:**	**0:0:0**		**Exam Duration (Hours)**	**:**	**03**	
Credits: 16							

PREREQUSITES

Practical explore and problem solution skills of Electrical Engineering areas.

COURSE OUTCOMES

After completing the major project phase-2, the students should be able to:

CO1. Develop working models.
CO2. Apply system integration skills.
CO3. Demonstrate technical writing and documentation skills.
CO4. Develop Project management skills.

GUIDELINES

There shall be an UG major-project phase-2, in collaboration with an Industry / department faculties / Educational institute of national repute of their specialization. The following points need be followed for UG Major Project Phase-2.

1. Students will have to continue the project chosen in the 7th semester for its implementation. Those who would like to go for external project with industry/an educational institute of national importance may continue the existing project or may choose different one as per the suggestion of external supervisor.
2. The UG major-project shall be submitted in a report form and presented.
3. In case students would like to work with other institute or industry, they have to take prior permission from the Coordinator/HoD /Dean.
4. In this phase student is expected to complete the project implementation and should keep the working model ready at the time of final internal demonstration/external examination.

REPORT FORMAT

Following points may be noted regarding the format of a report:

- A4 size, 1.5 inches margin on left side and 1 inch margin on remaining three sides.
- Times New Roman fonts:
  -Title of the Project: 24, Bold.
  -Main/Chapter Header (1, 2, etc..): 16, Bold.
  -Sub title: 14, Bold
  -Running Text: 12, Regular
  -Lines Spacing: 1.5 Lines

-Paragraph Beginning: 0pt (No Space)
-Paragraph Spacing: 6pt
-Figure Caption (Below Figure, Centre Justified)): 10, Regular Times New Roman
-Table Caption (Above Table, Centre Justified): 10, Regular Times New Roman
-References must be placed at the end of Report
-References must be cited in square brackets [1][2], [3-5], [6-9, 11, 14] etc.
- Report must be tested against Plagiarism as suggested by UGC.

COURSE ASSESSMENT

A. **Continuous Assessment** (Weightage **160 Marks**)

- Continues assessment will be carried out by internal supervisor/Guide.
- Project assessment will be carried out in a regular interval.

B. **End Sem Examination** (Weightage **240 Marks**)

- The evaluation shall be based on the report submitted and a viva-voce exam.