KALINGA UNIVERSITY, NAYA RAIPUR, CHHATTISGARH

Evaluation Scheme & Syllabus for

B. Tech.

(Electrical Engineering)

AS PER

AICTE MODEL CURRICULUM

UNDER

Faculty of Engineering
w.e.f. Session 2021-22

KALINGA UNIVERSITY NAYA RAIPUR
Bachelor of Technology (Electrical Engineering)
w.e.f Academic Session 2021-22

B-Tech(EE) 1st Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE101	Programming for Problem Solving	3	0	3	70	30	100
BTEE102	Emerging Domain in Electronics Engineering	3	0	3	70	30	100
BTEE103	Engineering Chemistry	3	1	4	70	30	100
BTEE104	Engineering Mathematics- I	3	1	4	70	30	100
BTEE105	English	2	0	2	70	30	100
BTEE106-P	Engineering Chemistry -Lab	0	2	1	30	20	50
BTEE107-P	Emerging Domain in Electronics Engineering-Lab	0	2	1	30	20	50
BTEE108-P	Programming for Problem Solving-Lab	0	2	1	30	20	50
BTEE109-P	Mechanical Workshop- Lab	0	2	1	30	20	50
Total		**14**	**10**	**20**	**470**	**230**	**700**

B-Tech(EE) 2nd Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE201	Fundamentals of Mechanical Engineering & Mechatronics	3	0	3	70	30	100
BTEE202	Basic Electrical Engineering	3	0	3	70	30	100
BTEE203	Engineering Physics	3	1	4	70	30	100
BTEE204	Engineering Mathematics- II	3	1	4	70	30	100
BTEE205	Artificial Intelligence for Engineering	2	0	2	70	30	100
BTEE206P	Engineering Physics -Lab	0	2	1	30	20	50
BTEE207P	Basic Electrical Engineering-Lab	0	2	1	30	20	50
BTEE208P	English Language-Lab	0	2	1	30	20	50
BTEE209P	Engineering Graphics & Design-Lab	0	2	1	30	20	50
Total		**14**	**10**	**20**	**470**	**230**	**700**
*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.							

B.Tech(EE)- Third Semester							
Subject Code	**Subject**	**Lecture**	**Tutorial/ Practical**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE301	Maths-III	3	1	4	70	30	100
BTEE302	Technical Communication	3	0	3	70	30	100
BTEE303	Electromagnetic Field Theory	3	1	4	70	30	100
BTEE304	Electrical Measurements & Instrumentation	3	1	4	70	30	100
BTEE305	Basic Signals & Systems	3	1	4	70	30	100
BTEE306P	Electrical Measurements and instrumentation Lab	0	2	1	30	20	50
BTEE307P	Electrical Workshop	0	2	1	30	20	50
BTEE308P	Mini Projector/ Internship Assessment*	0	2	2	30	20	50
Total		**15**	**10**	**23**	**440**	**210**	**650**

B.Tech(EE) -Fourth Semester							
Subject Code	**Subject**	**Lecture**	**Tutorial/ Practical**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE401	Analog Devices & Electronic Circuits	3	0	3	70	30	100
BTEE402	Universal Human Values	3	0	3	70	30	100
BTEE403	Digital Electronics	3	0	3	70	30	100
BTEE404	Electrical Machines-I	3	1	4	70	30	100
BTEE405	Networks Analysis & Synthesis	3	1	4	70	30	100
BTEE406P	Circuit Simulation Lab	0	2	1	30	20	50
BTEE407P	Electrical Machines - I Lab	0	2	1	30	20	50
BTEE408P	Digital Electronics Lab	0	2	1	30	20	50
BTEE409P	Analog Electronics Lab	0	2	**1**	30	20	50
Total		**15**	**10**	**21**	**470**	**230**	**700**
*The internship (6 weeks) conducted during summer break after IV semester and will be assessed during V semester.							

B.Tech(EE)- Fifth Semester							
Subject Code	**Subject**	**Lecture**	**Tutorial/ Practical**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE501	Power System - I	3	1	4	70	30	100
BTEE502	Control System	3	1	4	70	30	100
BTEE503	Electrical Machines-II	3	1	4	70	30	100
BTEE504	**Departmental Elective-I**	3	0	3	70	30	100
BTEE504A	Robotics						
BTEE504B	Sensors and Transducers						
BTEE504C	Industrial Automation and Control						
BTEE504D	Electrical Standards and Engineering Practices						
BTEE505	**Departmental Elective-II**	3	0	3	70	30	100
BTEE505A	Optimization Techniques						
BTEE505B	Neural Networks & Fuzzy System						
BTEE505C	Digital Signal Processing						
BTEE505D	Analog & Digital Communication						
BTEE506P	Power System-I Lab	0	2	1	30	20	50
BTEE507P	Control System Lab	0	2	1	30	20	50
BTEE508P	Electrical Machines – II Lab	0	2	1	30	20	50
BTEE509P	Mini Project or Internship Assessment*	0	2	2	30	20	50
Total		**15**	**11**	**23**	**470**	**230**	**700**

B.Tech(EE)- Sixth Semester							
Subject Code	**Subject**	**Lecture**	**Tutorial/ Practical**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTEE601	Power System-II	3	1	4	70	30	100
BTEE602	Microprocessor and Microcontroller	3	1	4	70	30	100
BTEE603	Power Electronics	3	1	4	70	30	100
BTEE604	**Departmental Elective-III**	3	0	3	70	30	100
BTEE604A	Special Electrical Machines						
BTEE604B	Electrical Machine Design						
BTEE604C	Digital Control System						
BTEE604D	Electrical and Hybrid Vehicles						
	Open Elective -I	3	0	3	70	30	100
BTOE605A	Real Time Systems						
BTOE605B	Embedded System						
BTOE605C	Introduction To Mems						
BTOE605D	Object Oriented Programming						
BTOE605E	Numerical Techniques						
BTOE605F	GIS & Remote Sensing						
BTOE605G	Understanding The Human Being Comprehensively- Human Aspirations And Its Fulfillment						
BTEE606P	Power System-II Lab	0	2	1	30	20	50
BTEE607P	Microprocessor and Microcontroller Lab	0	2	1	30	20	50
BTEE608P	Power Electronics Lab	0	2	1	30	20	50
Total		**15**	**9**	**21**	**440**	**210**	**650**
*The internship (6 weeks) conducted during summer break after VI semester and will be assessed during VII semester.							

B-Tech(EE) 7th Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total**
BTEE701	Electric Drives	3	1	4	70	30	100
	Departmental Elective-IV	3	0	3	70	30	100
BTEE702A	Utilization of Electrical Energy & Electric Traction						
BTEE702B	Introduction to Smart Grid						
BTEE702C	Computer Aided Power System Analysis						
BTEE702D	High Voltage Engineering						
	Departmental Elective-V	3	0	3	70	30	100
BTEE703A	Energy Efficiency & Conservation						
BTEE703B	Reliability Engineering						
BTEE703C	EHVAC &DC Transmission						
BTEE703D	Power Quality and Facts						
	Open Elective-II	3	0	3	70	30	100
BTEEOE704A	Digital & Social Media Marketing						
BTEEOE704B	Idea to Business Model						
BTEEOE704C	Machine Learning						
BTEEOE704D	Renewable Energy Resources						
BTEEOE704E	Operation Research						
BTEEOE704F	Value Relationship & Ethical Human Conduct –For A Happy & Harmonious Society						
BTEE705P	Electric Drives-Lab	0	2	1	30	20	50
BTEE706P	**Minor Project**	0	6	3	100	50	150
BTEE707P	**Internship Assessment ***	0	2	2	30	20	50
Total		**12**	**12**	**19**	**440**	**210**	**650**

B-Tech(EE) 8th Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total**
BTEE801	Project Management & Entrepreneurship	3	0	3	70	30	100
BTEE802	Power System Protection	3	0	3	70	30	100
	Open Elective-III	3	0	3	70	30	100
BTEEOE803A	Filter Design						
BTEEOE803B	Bioeconomics						
BTEEOE803C	Design Thinking						
BTEEOE803D	Introduction to Women's & Gender Studies						
BTEEOE803E	Quality Management						
BTEEOE803F	Modeling of Field Effects Nano Devices						
BTEEOE803G	Computerized Process Control						
BTEE804P	Power system Protection Lab	0	2	1	30	20	50
BTEE805P	**Project**	0	18	9	200	100	300
Total		**9**	**20**	**19**	**440**	**210**	**650**

Programme Educational Objectives

The educational objectives of UG program in Electrical and Electronics Engineering (EE) of Kalinga University, Burla are:

PEO1 To have sound knowledge of basic principles of electrical& electronics engineering, exposure to experimental setups including requisite knowledge in mathematics, sciences and basic engineering.

PEO2 To augment the workforce in areas of electrical power and electronics systems, electrical and electronic component manufacturing industries, related core engineering and software fields and be entrepreneurs eventually realizing the make in India dream.

PEO3 To have strong background to pursue higher studies, communicate effectively, become efficient team members and leaders.

PEO4 To inculcate strong ethical values and social responsibility.

PEO5 To lead in the conception, design and implementation of new products, processes, services and systems.

Program Outcomes

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

SEMESTERI

Programming for Problem Solving

BTEE101

Course Outcomes

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Module – 1 : **(Introduction to Programming)** **[08]**

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

Module – 2 : **(Arithmetic expressions & Conditional Branching)** **[08]**

Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associatively.

Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

Module – 3 : **(Loops & Functions)**

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Module – 4 : **(Arrays & Basic Algorithms)** **[08]**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions.

Basic Algorithms: Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

Module – 5 :**(Pointer& File Handling)** **[08]**

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation)

File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

Text books:

1. Schum‟s Outline of Programming with C by Byron Gottfried, McGraw-Hill.
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited,2015
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz
7. A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning – 2007.
8. Let Us C By Yashwant P. Kanetkar.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson.
10. Programming in C by Kochan Stephen G. Pearson Education – 2015.
11. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication.
12. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

Programming for Problem Solving Lab

BTEE108P

Course Outcomes

1. To write programs for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To write programs for conditional branching, iteration and recursion.
4. To write programs using functions and synthesize a complete program using divide and conquer approach.
5. write programs using arrays, pointers and structures.

Other Reference: - Use C Open Source Software referring Spoken Tutorial MOOC

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    Between 90-100%---------- Print „A"
    Between 80-90%---------- Print „B"
    Between 60-80%---------- Print „C"
    Between Below 60%---------- Print „D"
11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.
18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:

(i) List all the trains (sorted according to train number) that depart from a particular section.

(ii) List all the trains that depart from a particular station at a particular time.

(iii) List all he trains that depart from a particular station within the next one hour of a given time.

(iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

EMERGING DOMAIN IN ELECTRONICS ENGINEERING

(BTEE102)

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Understand the concept of PN Junction and devices.
2. Understand the concept of BJT, FET and MOFET.
3. Understand the concept of Operational amplifier
4. Understand the concept of measurement instrument.
5. Understand the working principle of different type of sensor and their uses.
6. Understand the concept of IoT system & Understand the component of IoT system

Unit	Topics	Lectures
I	**Semiconductor Diode**: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche)	**3**
	Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits	**3**
	Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes, Liquid-Crystal Displays.	**2**
II	**Bipolar Junction Transistor:** Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration	**4**
	Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer	**4**
III	**Operational Amplifiers:** Introduction, Op-Amp Basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator).Differential and Common-Mode Operation, Comparators.	**4**
	Introduction of IoT System, Components of IoT system: Microprocessor and Microcontroller, Bluetooth Technology, Wi-Fi Technology, Concept of Networking, Sensor Nodes, concept of cloud.	**4**
IV	**Digital Electronics:** Number system & representation. Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization upto 6 Variable.	**6**
	Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits.	**2**
V	**Fundamentals of Communication Engineering:** Basics of signal representation and analysis, Electromagnetic spectrum Elements of a Communication System, Need of modulation and typical applications, Fundamentals of amplitude modulation and demodulation techniques.	**4**
	Introduction to Data Communications: Goals and applications of Networks.	**4**
	General Model of Wireless Communication: Evolution of mobile radio communication fundamentals, GPRS, GSM, CDMA. Elements of Satellite & Radar Communication,	

Text Books:

1. Robert L. Boylestand / Louis Nashelsky "Electronic Devices and Circuit Theory", Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", McGraw Publication
3. George Kennedy, "Electronic Communication Systems", McGraw Publication
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press.
5. Jacob Millman, C.C. Halkias, Staya brataJit, "Electronic Devices and Circuits", McGraw Hill

6. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India

Course Outcomes: At the end of this course students will demonstrate the ability to:

7. Understand the concept of PN Junction and devices.
8. Understand the concept of BJT, FET and MOFET.
9. Understand the concept of Operational amplifier
10. Understand the concept of measurement instrument.
11. Understand the working principle of different type of sensor and their uses.
12. Understand the concept of IoT system & Understand the component of IoT system

EMERGING DOMAIN IN ELECTRONICS ENGINEERING-Lab

(BTEE107P)

Suggestive List of Experiments:

Part A

1. Study of various types of Active & Passive Components based on their ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
3. PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB
4. Winding shop: Step down transformer winding of less than 5VA.
5. Soldering shop: Soldering and disordering of Resistor in PCB. Soldering and disordering of IC in PCB. Soldering and disordering of Capacitor in PCB

Part B

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
5. Characteristic of BJT: BJT in CE configuration.
6. To study Operational Amplifier as Adder and Subtractor
7. Verification of Truth Table of Various Logic Gate.
8. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

ENGINEERING CHEMISTRY

BTEE103

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

Module-1 **[08]**

Atomic and Molecular Structure:

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

Module-2 **[08]**

Spectroscopic techniques and Applications:

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

Module-3 **[08]**

Electrochemistry

Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and ΔS). Lead storage battery. Corrosion; causes, effects and its prevention. Phase Rule and its application to water system.

Module-4 **[08]**

Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method).

Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeterand Dulong'smethos).

Module-5 **[08]**

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene) . General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

Reference Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry ByFre W., Billmeyer
7. Engineering ChemistryBy Satya Prakash

ENGINEERING CHEMISTRY- PRACTICAL

BTEE106P

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

List Of Experiments

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

NOTE: Choice of any 8 experiments from the above.

ENGINEERING MATHEMATICS-I

BTEE104

Course Outcomes

1. Remember the concept of matrices and apply for solving linear simultaneous equations.
2. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .
3. Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.
4. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
5. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

Module 1: Matrices [08]

Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix.

Module 2: Differential Calculus- I [08]

Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (n^{th} order derivatives), Leibnitz theorem and its application, Envelope, Involutes and Evolutes, Curve tracing: Cartesian and Polar co-ordinates.

Module 3: Differential Calculus-II [08]

Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

Module 4: Multivariable Calculus-I [08]

Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities).

Module 5: Vector Calculus [08]

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.

2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India
   Education Services Pvt. Ltd
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
9. Engineering Mathemathics – I. Reena Garg, 2018.

ENGLISH

BTEE105

Course Outcomes

1. Students will be enabled to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
2. Students would be able to create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will apply it at their work place for writing purposes such as Presentation/official drafting / administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to evaluate the correct & error-free writing by being well-versed in rules of English grammar & cultivate relevant technical style of communication & presentation at their work place & also for academic uses.
5. Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence.

Module 1- Basics of Technical English [08]

Technical English: Definition; Extent& Coverage; Dimensions; Reading; Skimming: Scanning Churning & Assimilation; Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc; Technical Communication; Approaches: Brevity; Objectivity; Simplicity; Utility & Clarity.

Listening: Active; Passive; Thinking strategies: Positive & Logical thinking; Speaking: Essentials Nuances & Modes of Speech Delivery.

Module 2- Components of Technical Writing [08]

Vocabulary Building: Select words; Concept of word formation; Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Synonyms; Antonyms; Abbreviations. Homophones. One word substitutes; Requisites of Sentences.

Module 3- Basic Technical Writing Skills [08]

Forms: Business writing: Principle; Purchase & Sales Letters; Drafts; Official Writing: Official Letter; D.O. Letter; Notices; Agenda; Minutes of Meeting; Sentence Structure; Phrases & Clauses in sentences; Coherence; Unity; Emphasis in Writing; Devices; Use of Writing methods in Documents; Techniques of writing.

Module 4- Common Grammatical Errors & Technical Style [08]

Subject-verb agreement; Correct usage: Noun; Pronoun; Agreement; Modifiers; Articles; Prepositions; Cliches; Redundancies; Technical Style: Features; Choice of words; Sentences: Descriptive; Narrative; Expository; Defining & Classifying; Length of paragraph; Writing of Introduction & Conclusion.

Module 5- Presentation Strategies & Oral Communications [08]

Analysis of locale; Audience; Modulating Style & Content; Speaking with confidence; Kinesics; Paralinguistic features of Voice-Dynamics: Pitch; Intonation; Stress & Rhythm; Conversation & dialogues; Communication at work-place; etc.

Text Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
4. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd., New Delhi.
5. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
6. English Grammar & Composition by Wren & Martin, S.Chand& Co. Ltd., New Delhi.
7. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
8. Personality Development, Harold R. Wallace &L.Ann Masters, Cengage Learning, New Delhi
9. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.
10. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
11. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
12. Spoken English- A manual of Speech and Phonetics by R.K.Bansal&J.B.Harrison, Orient Blackswan, 2013, New Delhi.
13. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

MECHANICAL WORKSHOP LAB

BTEE109P

Course Outcomes

1. Use various engineering materials, tools, machines and measuring equipments.
2. Perform machine operations in lathe and CNC machine.
3. Perform manufacturing operations on components in fitting and carpentry shop.
4. Perform operations in welding, moulding, casting and gas cutting.
5. Fabricate a job by 3D printing manufacturing technique

S. No.	Mechanical Workshop	Duration
1	**Introduction to Mechanical workshop material, tools and machines** To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section. To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.	**3 Hours**
2	**Machine shop** Demonstration of working, construction and accessories for Lathe machine Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.	**3 Hours**
3	**Fitting shop** 1. Practice marking operations. **2.** Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.	**3 Hours**
4	**Carpentry Shop** Study of Carpentry Tools, Equipment and different joints. Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tension Joint	**3 Hours**
5	**Welding Shop** Introduction to BI standards and reading of welding drawings.	

SEMESTER II

Fundamental of Mechanical Engineering and Mechatronics
BTEE201

Unit	Topics	Lectures
I	**Unit I: Introduction to Mechanics of Solid:** Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems. Types of beams under various loads, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment. Basic Numerical problems.	8
II	**Introduction to IC Engines and RAC:** **IC Engine:** Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. **Refrigeration:** Its meaning and application, unit of refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. Formula based numerical problems on cooling load. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.	10
III	**Introduction to Fluid Mechanics and Applications:** **Introduction:** Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law, Continuity Equation, Bernaulli's Equation and its applications, Basic Numerical problems. Working principles of hydraulic turbines & pumps and their classifications, hydraulic accumulators, hydraulic lift and their applications.	7
IV	**Measurements and Control System:** Concept of Measurement, Error in measurements, Calibration, measurements of pressure, temperature, mass flow rate, strain, force and torques; Concept of accuracy, precision and resolution, Basic Numerical problems. System of Geometric Limit, Fit, Tolerance and gauges, Basic Numerical problems. **Control System Concepts:** Introduction to Control Systems, Elements of control system, Basic of open and closed loop control with example.	8
V	**Introduction to Mechatronics:** Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics. **Overview of Mechanical Actuation System** – Kinematic Chains, Cam, Train Ratchet Mechanism, Gears and its type, Belt, Bearing. **Hydraulic and Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.	10

Reference Books:

1 Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2 Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers

3 Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4 Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5 Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6 Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

Basic Electrical Engineering
BTEE202

Course Outcomes

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Module - 1: DC Circuits [08]

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

Module - 2: Steady- State Analysis of Single Phase AC Circuits [08]

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module - 3 : Transformers [08]

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

Module –4 : Electrical machines [08]

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

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

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

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

Module –5 : Electrical Installations [06]

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries.Elementary calculations for energy consumption and savings, battery backup.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (http://spoken-tutorial.org)

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.
2. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

Basic Electrical Engineering Lab
BTEE207P

Course Outcomes

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

List Of Experiments

Note: A minimum of 8 experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single-phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer.
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

Engineering Physics
BTEE203

Course Outcomes:

1. To solve the classical and wave mechanics problems
2. To develop the understanding of laws of thermodynamics and their application in various processes
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams

Module - 1 Relativistic Mechanics: [8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson- Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein‟s mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Module- 2 Electromagnetic Field Theory: [8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell‟s equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

Module- 3 Quantum Mechanics: [8]

Black body radiation, Stefan‟s law, Wien‟s law, Rayleigh-Jeans law and Planck‟s law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Module- 4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton‟s Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh‟s criterion of resolution, Resolving power of grating.

Module- 5Fibre Optics & Laser: [10]

Fibre Optics**:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres. Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein‟s coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Reference Books:

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)

2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal& Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

Engineering Physics Lab
BTEE206P

Course Outcomes:

1. To determine the wavelength of sodium light by Newton‟s ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

List of Experiments

1. To determine the wavelength of sodium light by Newton‟s ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To measure attenuation in an optical fiber.
4. To determine the wavelength of He-Ne laser light using single slit diffraction.
5. To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism.
6. To determine the coefficient of viscosity of a given liquid.
7. To determine the value of acceleration due to gravity (g) using compound pendulum.
8. To determine the energy band gap of a given semiconductor material.
9. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
10. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
11. To study the resonance condition of a series LCR circuit.
12. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (KrishnaPrakashan Meerut)

Engineering Mathematics-II
BTEE204

Course Outcomes

1. Understand the concept of differentiation and apply for solving differential equations.
2. Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3. Understand the concept of convergence of sequence and series. Also evaluate Fourier series
4. Illustrate the working methods of complex functions and apply for finding analytic functions.
5. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals

Module 1: Ordinary Differential Equation of Higher Order [10]

Linear differential equation of n^{th} order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

Module 2: Multivariable Calculus-II [08]

Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

Module 3: Sequences and Series [08]

Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

Module 4: Complex Variable – Differentiation [08]

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy-Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

Module -5 Complex Variables – Integration [08]

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integral of the type $\int_0^{2\pi} f(cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger , Advance Engineering Mathematics , Narosa Publishing -House, 2002.

Reference Books:-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-Tata McGraw-Hill
6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi

Artificial Intelligence for Engineering
(BTEE205)

Course Outcomes

1. Understand the evolution and various approaches of AI
2. Understand data storage, processing, visualization, and its use in regression, clustering etc.
3. Understand natural language processing and chatbots
4. Understand the concepts of neural networks.
5. Understand the concepts of face, object, speech recognition and robots.

Course	Topics
Unit 1	**An overview to AI**
1.1 1.2 1.3 1.4 1.5	The evolution of AI to the present
	Various approaches to AI
	What should all engineers know about AI?
	Other emerging technologies
	AI and ethical concerns
Unit 2	**Data & Algorithms**
2.1 2.2 2.3 2.4 2.5 2.6	History Of Data
	Data Storage And Importance of Data and its Acquisition
	The Stages of data processing
	Data Visualization
	Regression, Prediction & Classification
	Clustering & Recommender Systems
Unit 3	**Natural Language Processing**
3.1 3.2 3.3 3.4 3.5	Speech recognition
	Natural language understanding
	Natural language generation
	Chatbots
	Machine Translation
Unit 4	**Artificial Neural Networks**
4.1 4.2 4.3 4.4 4.5	Deep Learning
	Recurrent Neural Networks
	Convolutional Neural Networks
	The Universal Approximation Theorem
	Generative Adversarial Networks
Unit 5	**Applications**
5.1 5.2 5.3 5.4 5.5	Image and face recognition
	Object recognition
	Speech Recognition besides Computer Vision
	Robots

	Applications

Reference Books:

3. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Prentice Hall
4. Artificial Intelligence by Kevin Knight, Elaine Rich, Shivashankar B. Nair, Publisher : McGraw Hill
5. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Jian Pei, Publisher: Elsevier Science.
6. Speech & Language Processing by Dan Jurafsky, Publisher : Pearson Education
7. Neural Networks and Deep Learning A Textbook by Charu C. Aggarwal, Publisher: Springer International Publishing
8. Introduction to Artificial Intelligence By Rajendra Akerkar, Publisher : PHI Learning

English Language Lab
BTEE208P

Course Objectives:

(i) To facilitate software based learning to provide the required English Language proficiency to students.

(ii) To acquaint students with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.

(iii) To train students to use the correct and error-free writing by being well versed in rules of English grammar.

(iv) To cultivate relevant technical style of communication and presentation at their work place and also for academic uses.

(v) To enable students to apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics.

SYLLABUS: PROFESSIONAL COMMUNICATION LAB SHALL HAVE TWO PARTS:
Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (LP.A.)

List of Practicals

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic /Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme Presentation/ Keynote Presentation based on correct methodologies argumentation.
7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio.

1. **Computer assisted software based Language Learning:** Software based self-guided learning to provide the required English language proficiency to students from an employability and career readiness standpoint. The software should align to Common European Framework of Reference for Languages (CEFR) and deliver a CEFR level – B2 upon completion.
2. **Interactive Communication Skills:** Students should practice the language with variety of activities and exercises based on employability skills as startup presentations, GD, Mock interview, Video portfolio, Extempore, Role play, Just A Minute (JAM) etc.

Suggested software:

1. **Oxford Achiever** by Oxford University Press.
2. **Cambridge English Empower** by Cambridge University Press.
3. **MePro.** by Pearson India Education Services Pvt. Ltd.

4. **New Interactions** by McGraw-Hill India.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. A Course in Phonetics and Spoken English, Sethi & Dhamija:, Prentice Hall
4. English Pronouncing Dictionary, Joans Daniel, Cambridge University Press, 2007.
5. English Grammar and Usage by R. P. Sinha, Oxford University Press, 2005, New Delhi.
6. English Grammar, Composition and Usage by N.K. Agrawal & F.T. Wood, Macmillan India Ltd., New Delhi.
7. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
8. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.
9. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
10. Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi
11. Personality Development & Soft Skills, Barun K. Mitra, Oxford University Press, 2012 New Delhi.

Engineering Graphics and Design-Lab
(BTEE209P)

Course Outcomes

1: Understanding of the visual aspects of engineering design
2: Understanding of engineering graphics standards and solid modelling
3: Effective communication through graphics
4: Applying modern engineering tools necessary for engineering practice
5: Appling computer-aided geometric design
6: Analysis of Isometric views
7: Creating working drawings

Module 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales

Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

Module 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.

Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

Module 3: Isometric Projections [08]

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conversions.

Module 4: Computer Graphics [08]

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects: Isometric Views of lines, Planes, Simple and compound Solids];

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles:

Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to pater using the print command: orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.

Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling.

Module 5: Demonstration of a simple team design project [08]

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/ Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R. (2014), Engineering Drawing, Charotar Publishing House.

(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

(iii) Agrawal B. & Agrawal C.M. (2012), Engineering Graphics, TMH Publication

(iv) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House

(v) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

(Corresponding set of) CAD Software Theory and User Manuals

SEMESTER III

BTEE-301 –Mathematic s-III(PDE.ProbabilityandStatistics)

Course Outcomes

The objective of this course is to familiarize the students with partial differential equation, their application and statistical techniques. It aims to present the students with standard concepts and tools at an intermediate to superior level that will provide them well towards undertaking a variety of problems in the discipline.

The students will learn:

- The idea of partial differentiation and types of partial differential equations
- The idea of classification of second partial differential equations, wave , heat equation and transmission lines
- The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.
- The idea s of probability and random variables and various discrete and continuous probability distributions and their properties.
- The statistical methods of studying data samples, hypothesis testing and statistical quality control, control charts and their properties.

Module I: Partial Differential Equations

Origin of Partial Differential Equations, Linear and Non Linear Partial Equations of first order, Lagrange's Equations, Charpit's method, Cauchy's method of Characteristics, Solution of Linear Partial Differential Equation of Higher order with constant coefficients, Equations reducible to linear partial differential equations with constant coefficients.

Module II: Applications of Partial Differential Equations:

Classification of linear partial differential equation of second order, Method of separation of variables, Solution of wave and heat conduction equation up to two dimension, Laplace equation in two dimensions, Equations of Transmission lines.

Module III: Statistical Techniques I:

Introduction: Measures of central tendency, Moments, Moment generating function (MGF) , Skewness, Kurtosis, Curve Fitting , Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves ,Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non linear regression.

Module IV: Statistical Techniques II:

Probability and Distribution: Introduction, Addition and multiplication law of probability, Conditional probability, Baye's theorem, Random variables (Discrete and Continuous Random variable) Probability mass function and Probability density function, Expectation and variance, Discrete and Continuous Probability distribution: Binomial, Poission and Normal distributions.

Module V: **Statistical Techniques III:**

Sampling, Testing of Hypothesis and Statistical Quality Control: Introduction , Sampling Theory (Small and Large) , Hypothesis, Null hypothesis, Alternative hypothesis, Testing a Hypothesis, Level of significance, Confidence limits, Test of significance of difference of means, T-test, F-test and Chi-square test, One way Analysis of Variance (ANOVA).Statistical Quality Control (SQC) , Control Charts , Control Charts for variables ($\overline{X}$ and R Charts), Control Charts for Variables (p, np and C charts).

Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003(Reprint).
3. S. Ross: A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

Reference Books

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
2.T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
3. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.
4. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
5. D.N.Elhance,V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

COURSEOUTCOMES

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
	At the end of this course, the students will be able to:	
CO 1	Remember the concept of partial differential equation and to solve partial differential equations	K_1& K_3
CO 2	Analyze the concept of partial differential equations to evaluate the problems concerned with partial differential equations	K_4 & K_5
CO 3	Understand the concept of correlation, moments, skewness and kurtosis and curve fitting	K_2
CO 4	Remember the concept of probability to evaluate probability distributions	K_1 & K_5
CO 5	Apply the concept of hypothesis testing and statistical quality control to create control charts	K_3 & K_6

K_1 – Remember, K_2 – Understand, K_3 – Apply, K_4 – Analyze, K_5 – Evaluate, K_6 – Create

Evaluation methodology to be followed:

The evaluation and assessment plan consists of the following components:

a. Class attendance and participation in class discussions etc.
b. Quiz.
c. Tutorials and assignments. d. Sessional examination.
e. Final examination.

Award of Internal/External Marks:

Assessment procedure will be as follows:

1. These will be comprehensive examinations held on-campus (Sessionals).
2. Quiz.
   a. Quiz will be of type multiple choice, fill-in-the-blanks or match the columns. b. Quiz will be held periodically.
3. Tutorials and assignments
   a. The assignments/home-work may be of multiple choice type or comprehensive type at least one assignment from each Module/Unit.
   b. The grades and detailed solutions of assignments (of both types) will be accessible online after the submission deadline.
4. Final examinations.

Technical Communication (BTEE302)

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Unit -1 Fundamentals of Technical Communication:

Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication

Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph

Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit - II Forms of Technical Communication:

Technical Report: Definition & importance;

Thesis/Project writing: structure & importance; synopsis writing: Methods

Technical research Paper writing: Methods & style; Seminar & Conference paper writing; **Key-Note Speech:** Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit - III Technical Presentation: Strategies & Techniques

Presentation: Forms; interpersonal Communication; Class room presentation; style; method;

Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation;

Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest

Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - IV Technical Communication Skills:

Interview skills, Group Discussion: Objective & Method; Seminar/Conferences Presentation

skills: Focus; Content; Style; Argumentation skills; Devices; Analysis; Cohesion & Emphasis; Critical thinking;

Nuances: Exposition narration & Description; effective business communication competence; Grammatical;

Discourse competence: combination of expression & conclusion;

Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.

Unit - V Kinesics & Voice Dynamics:

Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent

Linguistic features of voice control: Vowel & Consonant Sounds.

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi

ELECTROMAGNETIC FIELD THEORY (BTEE303)

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Apply different coordinate systems and their application in electromagnetic field theory, establish a relation between any two systems and also understand the vector calculus.	K_3
CO2	Understand the concept of static electric field. Understand the concept of current and properties of conductors. Establish boundary conditions and to calculate capacitances of different types of capacitors	K_4
CO3	Understand the concept of static magnetic field, magnetic scalar and vector potential	K_4
CO4	Understand the forces due to magnetic field, magnetization, magnetic boundary conditions and inductors.	K_4
CO5	Understand displacement current, time varying fields, propagation and reflection of EM waves and transmission lines.	K_3

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed

Syllabus: UNIT I
Coordinate Systems and Transformation: Basics of Vectors: Addition, subtraction and multiplications; Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.

Unit II
Electrostatic fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law- Maxwell's equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson's and
Laplace's equations., Methods of Images.

Unit III
Magneto statics : Magneto-static fields, Biot - Savart's Law, Ampere's circuit law, Maxwell's equation, Application of ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential.

Unit IV
Magnetic forces: Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy.

Unit V

Waves and Applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, Displacement current, Maxwell's equation in final form Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics Plane wave in free space. Plain waves in good conductors, Power and the pointing vector, Reflection of a plain wave in a normal incidence. Transmission Lines and Smith Chart.

Text Book: 1. MNO Sadiku, "Elements of Electromagnetic', Oxford University Press.

Reference Books: 1. WH Hayt and JA Buck, "Engineering Electromagnetic", McGraw- Hill Education.

ELECTRICAL MEASUREMENTS & INSTRUMENTATION (BTEE304)

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Evaluate errors in measurement as well as identify and use different types of instruments for the measurement of voltage, current, power and energy.	K_1
CO2	Display the knowledge of measurement of electrical quantities resistance, inductance and capacitance with the help of bridges.	K_2
CO3	Demonstrate the working of instrument transformers as well as calculate the errors in current and potential transformers.	K_2
CO4	Manifest the working of electronic instruments like voltmeter, multi-meter, frequency meter and CRO.	K_2
CO5	Display the knowledge of transducers, their classifications and their applications for the measurement of physical quantities like motion, force, pressure, temperature, flow and liquid level.	K_3

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I

Electrical Measurements: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Review of indicating and integrating instruments: Voltmeter, Ammeter and Wattmeter.

UNIT II

Measurement ofResistance, Inductance and Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

UNIT III

Instrument Transformers: Current and Potential transformer, ratio and phase angle errors, design considerations and testing.

UNIT IV

Electronic Measurements: Electronic instruments: Voltmeter, Multimeter, Wattmeter & energy meter. Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum & Wave analyzer,Digital counter, frequency meter,and Digital Voltmeter.

UNIT V

Instrumentation: Transducers& sensors,classification & selection of sensors, Measurement of force using strain gauges, Measurement of pressure using piezoelectric sensor, Measurement of temperature using Thermistors and Thermocouples, Measurement of displacement using LVDT, Measurement of position using Hall effect sensors.Concept of signal conditioning and data acquisition systems, Concept of smart sensors and virtual instrumentation.

Text Book:

1. A K Sawhney, "Electrical & Electronic Measurement & Instrument", DhanpatRai&Sons, India
2. BC Nakra& K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2nd Edition
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH

Reference Books:

1. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
2. M. Stout , "Basic Electrical Measurement", Prentice Hall of India
3. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
4. EW Golding & F.C. Widdis, "Electrical Measurement &Measuring Instrument", AW Wheeler & Co. Pvt. Ltd. India

BASIC SIGNAL & SYSTEMS (BTEE305)

Pre-requisites of course: Basic Electrical Engineering, Engineering Mathematics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Represent the various types of signals & systems and can perform mathematical operations on them.	K_2
CO2	Analyze the response of LTI system to Fourier series and Fourier transform and to evaluate their applications to network analysis.	K_4
CO3	Analyze the properties of continuous time signals and system using Laplace transform and determine the response of linear system to known inputs.	K_4
CO4	Implement the concepts of Z transform to solve complex engineering problems using difference equations.	K_3
CO5	Develop and analyze the concept of state-space models for SISO & MIMO system.	K_4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I

Pre- Requisites: *Differential Equations.*

Introduction to Continuous Time Signals and Systems: Introduction to continuous time and discrete time signals, Classification of signals with their mathematical representation and characteristics. Transformation of independent variable, Introduction to various type of system, basic system properties.

Analogous System: Linear& Rotational mechanical elements, force-voltage and force-current analogy,

modeling of mechanical and electro-mechanical systems: Analysis of first and second order linear systems by classical method.

UNIT II

Pre- Requisites: *Fourier Series & Fourier Transform*

Fourier Transform Analysis: Exponential form and Compact trigonometric form of Fourier series, Fourier symmetry, Fourier transform: Properties, application to network analysis. Definition of DTFS, and DTFT, Sampling Theorem.

UNIT III

Pre- Requisites: *Laplace Transform*

Laplace Transform Analysis: Review of Laplace Transform, Properties of Laplace Transform, Initial & Final value Theorems, Inverse Laplace Transform, Convolution Theorem, Impulse response, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform to complex waveforms

UNIT IV

Pre- Requisites:*Matrix Calculations.*

State – Variable analysis: Introduction, State Space representation of linear systems, Transfer function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State – Variable technique to the analysis of linear systems.

UNIT V

Pre- Requisite: *Z-Transforms.*

Z – Transform Analysis: Concept of Z – Transform& ROC, Z – Transform of common functions,
Inverse Z – Transform, Initial & Final value Theorems, Applications to solution of difference equations, Properties of Z-transform.

Text Books:

1. Oppenhiem, Wilsky, Nawab, "Signals & Systems", PHI
2. Anand Kumar, "Signals & Systems", PHI
3. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.

Reference Books:

1. David K. Cheng; "Analysis of Linear System", Narosa Publishing Co
2. Donald E. Scott, "Introduction to circuit Analysis" Mc. Graw Hill
3. BP Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
4. IJ Nagrath, S.N. Saran, R. Ranjan and S. Kumar, "Signals and Systems", TataMc.Graw Hill, 2001.
5. ME Van-Valkenberg; " Network Analysis", Prentice Hall of India

ELECTRICAL MEASUREMENT AND INSTRUMENTATION LAB (BTEE306P)

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Understand the importance of calibration of measuring instruments.	K2
CO2	Demonstrate the construction and working of different measuring instruments.	K3
CO3	Demonstrate the construction and working of different AC and DC bridges, along with their applications.	K3
CO4	Ability to measure electrical engineering parameters like voltage, current, power & phase difference in industry as well as in power generation, transmission and distribution sectors.	K2
CO5	Capability to analyze and solving the variety of problems in the field of electrical measurements.	K2

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note : Minimum ten experiments are to be performed from the following list:

1. Calibration of AC voltmeter and AC ammeter.
2. Measurement of inductance using Maxwell's Bridge.
3. Measurement of capacitance using Schering Bridge.
4. Measurement of low resistance using Kelvin's Double Bridge.
5. Measurement of Power using CT and PT.
6. Measuring displacement using LVDT.
7. Measuring temperature using thermocouple.
8. Measuring pressure using piezoelectric pick up.
9. Measurement of speed of DC motor by photoelectric pick up.
10. Speed measurement using Hall Effect sensor.
11. PC based data logging of temperature sensor using LabVIEW/ MATLAB.
12. Signal conditioning of analog signal using LabVIEW/ MATLAB.

ELECTRICAL WORKSHOP (BTEE307P)

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Perform various types of Electrical connections.	K_3
CO2	Develop small circuits on PCB	K_6
CO3	Differentiate between various electrical wires, cables and accessories.	K_3
CO4	Demonstrate the layout of electrical substation & various safety measures.	K_2

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Note: Minimum ten experiments are to be performed from the following list:

1. To study the working and Control of two lamps in series and in parallel
2. To perform the stair case working and it's testing.
3. To study the working principle and wiring of fluorescent lamp.
4. To study and wiring of distribution board including power plug using isolator, MCB, ELCB.
5. To study and estimate a typical, BHK house wiring.
6. Familiarization, soldering, testing and observing the wave forms on CRO of a HW and FW uncontrolled rectifier (using diodes) with capacitor filter.
7. Visit your college substation and familiarize the supply system, Transformer, HT Paneland Distribution etc.
8. To study construction, working and application of workshop tools. Also study the Electrical and Electronics Symbols.
9. To study the wires, cables and their gauges, Domestic Electrical Accessories.
10. Mini Project on PCB.
11. To study fault, Remedies in Domestic Installation and Indian Electricity Rules.
12. To study the different types of earthing system and measure the earth resistance.

Mini Projector / Internship Assessment (BTEE308P)

Semester -IV

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Choose proper semiconductor device for various applications.	K_3
CO2	Analyze the Special Diodes and Power Devices with their characteristics and applications.	K_4
CO3	Analyze the structure operation, V-I characteristics and detail circuit of BJT with help of small signal model.	K_4
CO4	Analyze the structure operation, V-I characteristics and detail circuit of MOSFET with help of small signal model.	K_4
CO5	Demonstrate the use of Op-Amp circuits and its internal parameters along with its applications.	K_3

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I
Semiconductors: Charge carriers, Hall effects.
Diode: P-N Junction, Current Equation, Equilibrium condition, Forward & Reverse biased junction, Junction-capacitance breakdown characteristic, I-V Characteristics of a diode, Review of half-wave and Full-wave rectifiers, Zener diodes, Clamping and Clipping circuit.

Unit II
Special Diodes: LED, Photo-diode, Schottky diode, Tunnel diode, their characteristics and applications.
Uni Polar Devices: FET, MOSFET.
Introduction to Power devices: Characteristics of SCR, TRIAC, DIAC. UJT.

Unit III
BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.

Unit IV
MOSFET: Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier.

Unit V
Ideal Op-Amp, non-idealities in an Op-Amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)
Idealized analysis of Op-Amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, Integrator, Differentiator.

Text Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices And Circuits Theory” Pearson India.
2. AS Sedra and K.C. Smith “Microelectronics Circuits” Oxford University Press (India)
3. R. A. Gayakwad “Op amps and Linear Integrated Circuits” Prentice Hall of India.
4. Balbir Kumar and Shail B. Jain, “Electronic Devices and Circuits” Prentice Hall of India, 2007
5. BG Streetman and S. Banerjee, “Solid State Electronics Devices” Prentice Hall of India.

Reference Books:

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices And Circuits Theory” Pearson India
2. Millman, J. and Christos Halkias, “Electronics Devices and Circuits” TataMcGraw Hill.
3. Aloke. K. Dutta, “Semiconductor Devices and circuits”, Oxford University Press, 2008.

Universal Human Values and Professional Ethics

[BTEE402]

Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcome:

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

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT-1

Course Introduction- Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2

Understanding Harmony in the Human Being- Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4

Understanding Harmony in the Nature and Existence- Whole existence so-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values),

Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation:
Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

DIGITAL ELECTRONICS (BTEE403)

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Apply concepts of Digital Binary System and implementation of Gates.	K_3
CO2	Analyze and design of Combinational logic circuits.	K_4
CO3	Analyze and design of Sequential logic circuits with their applications.	K_4
CO4	Implement the Design procedure of Synchronous & Asynchronous Sequential Circuits.	K_3
CO5	Apply the concept of Digital Logic Families with circuit implementation.	K_3

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus

UNIT I

Digital System And Binary Numbers: Number System and its arithmetic, Signed binary numbers, Binary codes, Cyclic codes, Hamming Code, the map method up to five variable, Don't care conditions, POS simplification, NAND and NOR implementation, Quine McClusky method (Tabular method).

UNIT II

Combinational Logic: Combinational Circuits: Analysis Procedure, Design procedure, Binary adder-subtractor, Decimal adder, Binary multiplier, Magnitude comparator, Multiplexers, Demultiplexers, Decoders, Encoders.

UNIT III

Sequential Logic And Its Applications: Storage elements: latches & flip flops, Characteristic Equations of Flip Flops, Flip Flop Conversion, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters: Johnson & Ring Counter.

UNIT IV

Synchronous & Asynchronous Sequential Circuits: Analysis of clocked sequential circuits with state machine designing, State reduction and assignments, Design procedure. Analysis procedure of Asynchronous sequential circuits, circuit with latches, Design procedure, Reduction of state and flow table, Race-free state assignment, Hazards.

UNIT V

Memory & Programmable Logic Devices: Digital Logic Families: DTL, DCTL, TTL, ECL & CMOS etc., Fan Out, Fan in, Noise Margin; RAM, ROM, PLA, PAL; Circuits of Logic Families, Interfacing of Digital Logic Families, Circuit Implementation using ROM, PLA and PAL; CPLD and FPGA.

Text Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press.
3. RP Jain, "Modern Digital Electronics", Tata McGraw Hill Publication.

ELECTRICAL MACHINES – I (BTEE404)

Pre-requisites of course: Basic Electrical Engineering, Engineering Mathematics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Analyze the various principles & concepts involved in Electromechanical Energy conversion.	K_4
CO2	Demonstrate the constructional details of DC machines as well as transformers, and principle of operation of brushless DC motor, Stepper and DC Servo motors.	K_2
CO3	Evaluate the performance and characteristics of DC Machine as motor and as well as generator.	K_4
CO4	Evaluate the performance of transformers, individually and in parallel operation.	K_4
CO5	Demonstrate and perform various connections of three phase transformers.	K_3

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I

Pre- Requisites: *Magnetic Materials, BH characteristics*

Principles of Electro-mechanical Energy Conversion: Introduction, Review of magnetic system, Energy in Magnetic system, Force and torque in magnetic field system, Energy balance equation, Energy conversion via electrical field, Energy in a singly excited system, Determination of the Force and Torque from energy and co-energy, Generation of EMF in Machines, Torque in machine with cylindrical air gap.

UNIT II
Pre- Requisites: *Principle & Construction, Classification and circuit model, EMF equation of generator and torque equation of motor*

DC Machines: Armature winding (Concentrated and Distributed), Winding Factor, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators, Applications.

UNIT III
DC Machines (Contd.): Performance characteristics of DC motors, Starting of DC motors; 3 point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward Leonard method); Efficiency and Testing of DC machines (Hopkinson's and Swinburne's Test), Applications, ***Introduction to Brushless DC Motor, stepper motor and DC Servo motor and their applications.***

UNIT IV

Pre- Requisites: *Construction & Principle, Ideal and practical transformer, equivalent circuit & phasor diagram, losses in transformers.*

Single Phase Transformer: Efficiency and voltage regulation, all day efficiency, Excitation phenomenon and harmonics in transformers.

Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test.

Auto Transformer- Single phase and three phase autotransformers, Volt-amp relation, Copper saving in autotransformer Efficiency, Merits & demerits and applications.

UNIT V

Pre- Requisite: *Three-phase connections – Star/Delta.*

Three Phase Transformers: Construction, Three phase transformer, phasor groups and their connections, open delta connection, three phase to 2 phase and their applications, Three winding transformers. Parallel operation of single phase and three phase transformers and load sharing.

Text Books:

1. IJ Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

1. H. Cotton, "Electrical Technology", CBS Publication.
2. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
3. PS Bimbhra, " Generalized Theory.

NETWORK ANALYSIS & SYNTHESIS (BTEE405)

Pre-requisites of course: Basic Electrical Engineering, Basic signal & systems.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Apply the knowledge of basic circuital law, nodal and mesh methods of circuit analysis and simplify the network using Graph Theory approach.	K_3
CO2	Analyze the AC and DC circuits using Kirchhoff's law and Network simplification theorems.	K_4
CO3	Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods.	K_4
CO4	Demonstrate the concept of complex frequency and analyze the structure and function of one and two port network. Also evaluate and analysis two-port network parameters.	K_4
CO5	Synthesize one port network and analyze different filters.	K_4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I

Graph Theory:

Pre- Requisites: *Basic circuital law, Mesh & Nodal analysis.*

Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar &Non- Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

Unit II

AC Network Theorems (Applications to dependent & independent sources):

Pre- Requisites: *Concepts of DC Network Theorems, Electrical Sources&Basic circuital law.*

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

Unit III

Transient Circuit Analysis:

Pre- Requisites: *Laplace Transform& Concept of Initial conditions.*

Natural response and forced response, Transient response andsteady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

Unit IV

Network Functions:

Pre- Requisites: *Concept of basic circuital law, parallel, series circuits.*

Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions. Two Port Networks- Characterization of LTI two port networks; Z, Y,ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections of two port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.

Unit V

(a)Network Synthesis:

Pre- Requisites: *Laplace Transform, Concept of immittance functions.*

Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters

Pre- Requisites: *Concept of Passive & active elements.*

Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. ME Van Valkenburg, "Network Analysis", Prentice Hall of India.
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill.
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. CL Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill.
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill.
3. ME Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T.S.K.V. Iyer, "Circuit Theory", Tata McGraw Hill.
5. Samarjit Ghosh, " Network Theory: Analysis & Synthesis" Prentice Hall India.

CIRCUIT AND SIMULATION LAB (BTEE406P)

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Apply the knowledge of basic circuital law, nodal and mesh analysis for given circuit.	K2
CO2	Analysis of the AC and DC circuits using simulation techniques.	K3
CO3	Analysis of transient response of AC circuits.	K3
CO4	Evaluation and analysis of two-port network parameters.	K2
CO5	Estimation of parameters of different filters.	K2

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

ListofExperiments

Ten experiments to be performed

1) Verification of principle of Superposition with AC sources using Multisim/ PSPICE.
2) Verification of Thevenin and Maximum Power Transfer theorems in AC Circuits using Multisim/ PSPICE.
3) Verification of Norton theorems in ACCircuits using Multisim/ PSPICE.
4) Verification of Tellegen's theorem for two networks of the same topology using Multisim/ PSPICE.
5) Determination of Z and h-parameters (DC only) for a network and computation of Y and ABCD Parameters using Multisim/ PSPICE.
6) Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values using Multisim/ PSPICE.
7) Determination of transient response of current in RL and RC circuits with step

voltageinput.

8) Determination of transient response of current in RLC circuit with step voltage inputforunder damped, critically damped and over damped cases.

9) Determination of image impedance and characteristic impedance of T and ΠInetworks, using

O.C. and S.C. tests.

10) Verification of parameter properties in inter-connected two port networks: series, paralleland cascade using Multisim/ PSPICE.

11) Determination of frequency response of a Twin – T-notch filter.

12) To determine attenuation characteristics of a low pass / high pass active filters.

ELECTRICAL MACHINES-I (BTEE407P) LAB

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Analyze and conduct basic tests on DC Machines and single-phase Transformer	K2
CO2	Obtain the performance indices using standard analytical aswell as graphical methods.	K3
CO3	Determine the magnetization, Load and speed-torque characteristics of DC Machines.	K3
CO4	Demonstrate procedures and analysis techniques to perform electromagnetic and electromechanical tests on electrical machines.	K2

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

List of Experiments

Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software-based experiments.

1. To obtain magnetization characteristics of a DC shunt generator.
2. To obtain load characteristics of a DC shunt generator andcompound generator (a) Cumulatively compounded (b) Differentially compounded.
3. To obtain efficiency of a DC shunt machine using Swinburne's test.
4. To perform Hopkinson's test and determine losses and efficiency of DC machine.
5. To obtain speed- torque characteristics of a DC shunt motor.
6. To obtain speed control of DC shunt motor using (a) armature resistance control (b) field control
7. To obtain speed control of DC separately excited motor using Ward-Leonard.
8. To obtain equivalent circuit, efficiency and voltage regulation of a single-phase transformer using O.C. and S.C. tests.
9. To obtain efficiency and voltage regulation of a single-phase transformer by Sumpner's test.
10. To obtain 3-phase to2-phase conversion by Scott connection.
11. To demonstrate the parallel operation of three phase transformer and to obtain the load sharing at a load.

Institute may add any two software-based experiments [Develop computer Program in 'C'
language

DIGITAL ELECTRONICS LAB (BTEE408P)

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Understanding of Digital Binary System and implementation of Gates.	K_2 , K_3
CO2	Design the Sequential circuits with the help of combinational circuits and	K_3, K_4
CO3	Design data selector circuits with the help of universal Gates.	K_3, K_4
CO4	Design the counters with the help of sequential circuit and basic Gates.	K_3, K_4
CO5	Implement the projects using the digital ICs and electronics components.	K_3, K_5

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.

2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.

4. Implementation and verification of Decoder using logic gates.

5. Implementation and verification of Encoder using logic gates.

6. Implementation of 4:1 multiplexer using logic gates.

7. Implementation of 1:4 demultiplexer using logic gates.

8. Implementation of 4-bit parallel adder using 7483 IC.

9. Design, and verify the 4-bit synchronous counter.

10. Design, and verify the 4-bit asynchronous counter.

11. Implementation of Mini Project using digital integrated circuit's and other components.

ANALOG ELECTRONICS LAB (BTEE409P)

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Understand the characteristics and applications of the Semiconductor devices.	K_2, K_3
CO2	Draw the characteristics of BJT, FET and MOSFET.	K_2, K_4
CO3	Understand the parameters of Operational Amplifier and instrumentation Amplifier with their applications.	K_2, K_4
CO4	Understand the V-I characteristics of Power devices like SCR, TRIAC.	K_2, K_4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

1. To Plot V-I characteristics of P-N junction diode and Zener diode.

2. To draw wave shape of the electrical signal at input and output points of the half wave, full wave and bridge rectifiers.

3. To Plot input / output characteristics for common base transistor.

4. To determine voltage gain, current gain, input impedance and output impedance and frequency response of
R-C coupled common emitter amplifier.

5. To Plot input /output characteristics of FET and determine FET parameters at a given operating point.

6. To Plot input /output characteristics of MOSFET and determine MOSFET parameters at a given operating point.

7. To study transistor as a switch and determine load voltage and load current when the transistor is ON.

8. Measurement of Operational Amplifier Parameters: Common Mode Gain, Differential Mode Gain, CMRR, Slew Rate.

9. Applications of Op-amp: Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator.

10. Study of Instrumentation Amplifier.

11. To plot V-I characteristics of SCR.

12. To plot V-I characteristics of TRIAC.

Semester -V

POWER SYSTEM-I
BTEE501

Course Outcomes: After completion of the course student will be able to:

1. Describe the working principle and basic components of conventional power plants as well as the other aspects of power generation.
2. Recognize elements of power system and their functions, as well as compare the different types of supply systems. Illustrate different types of conductors, transmission lines and various performance parameters of transmission line for short, medium and long transmission line.
3. Calculate sag and tension in overhead lines with and without wind and ice loading. Classify different type of insulators, determine potential distribution over a string of insulator, string efficiency and its improvement.
4. Compute the inductance and capacitance of single phase, three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and understand the effect of earth on capacitance of transmission lines.
5. Elucidate different types of cables and assess the Resistance and capacitance parameters of cables, grading of cables and compare overhead lines and cables.

Unit 1
(Power Generation):

Introduction: Basic structure of power system, sources of electric energy: conventional and non-conventional; Layout of Hydro-electric, Thermal and Nuclear power plants, Concept of cogeneration, combined heat and power, and captive power plants. Load curve, load duration curve, Concept of Connected Load, Maximum Demand, Average load, Demand Factor, Load factor, Diversity Factor, Capacity Factor, Utilization factor, Plant use factor, Installed capacity, Reserves, role of load diversity in power system economy. Load Sharing between Base load and Peak Load

Unit 2
(Transmission & Distribution of Electric Power- I):
Single line diagram of Power system, choice of transmission voltage, Different kinds of supply system and their comparison.

Configurations of transmission lines: Types of conductors, Bundled Conductors, resistance of line, skineffect, Kelvin's law, Proximity effect,

Corona Effect, factors affecting the Corona, Corona Power Loss, Advantages and Disadvantages. **Performance of Lines**: Representation of lines, short transmission lines, medium length lines, nominal T andл-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect.

Unit 3
(Transmission & Distribution of Electric Power- II):
Mechanical Design of Over Headlines: Catenary curve, calculation of sag & tension, effects of wind and iceloading, sag template, vibration dampers

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

Unit 4
(Transmission Line Parameters):

Inductance and Capacitance Calculations of Transmission Lines: Line conductors, inductance andcapacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, Composite conductors-transposition, bundled conductors, and effect of earth on capacitance.

Unit 5
(Insulated Cables):

Insulated Cables: Introduction, insulation, insulating materials, Extra high voltage cables, grading of cables,insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables

Text Books

1. Kothari & Nagrath, "Power System Engineering", Tata McGraw-Hill Education
2. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
3. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A textbook on Power Systems Engg.', Dhanpat Rai and Sons, New Delhi.
4. JB Gupta, 'A course in Power Systems', S.K. Kataria and Sons.
5. C.L. Wadhwa, "Electrical Power System", New age international Ltd. Third Edition.
6. A. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control "John Wiley & Sons

References Books

1. Wadhwa, C.L., 'Generation Distribution and Utilization of Electrical Energy', New Age International publishers.
2. Deshpande M.V, `Elements of Electrical Power systems Design', Pitman, New Delhi, PHI Learning Private Limited,
3. S.N. Singh, "Electric Power Generation, Transmission &Distribution", PHI Learning..

CONTROL SYSTEM
BTEE502

Course Outcomes: After completion of the course student will be able to:

1. Obtain transfer functions to predict the correct operation of open loop and closed loop control systems and identify the basic elements, structures and the characteristics of feedback control systems.
2. Measure and evaluate the performance of basic control systems in time domain. Design specification for different control action.
3. Analyze the stability of linear time-invariant systems in time domain using Routh- Hurwitz criterion and root locus technique.
4. Determine the stability of linear time-invariant systems in frequency domain using Nyquist criterion and Bode plot.
5. Design different type of compensators to achieve the desired performance of control System by root locus and Bode plot method. Develop and analyze the intermediate states of the system using state space analysis.

Unit 1

Control System Concepts: Elements of control systems, concept of open loop and closed loop systems, Examples and application of open loop and closed loop systems, Mathematical Modeling of Physical Systems (Electro Mechanical), Determination of transfer function by block diagram reduction techniques and signal flow method using Mason's gain formula, Basic Characteristics of negative feedback control systems.

Control System Components: Constructional and working concept of AC & DC servomotor, synchro's, stepper motor and tachometer.

Unit 2

Time Response Analysis: Standard test signals, time response analysis of first and second order systems, timeresponse specifications of second order system for unit step input, location of roots of characteristics equation and corresponding time response, steady state errors and error constants.

Basic modes of feedback control: Proportional, Derivative, Integral and PID controllers.

Unit 3

Stability and Algebraic Criteria: Concept of stability and its necessary conditions, Routh-Hurwitz criteria and its limitations.

Root Locus Technique: Salient features of root locus plot, Procedure for plotting root locus, root contours.

Unit 4

Frequency Response Analysis: Frequency Response analysis from transfer function model, Construction of polar and inverse polar plots.

Stability in Frequency Domain: Nyquist stability criterion, Determination of gain and phase margin from Bode & Nyquist Plots, Correlation between time and Frequency Responses.

State Space Technique: The concept of state & space, State-space model of physical system, conversion of state-space to transfer function model and vice-versa, State transition matrix, Concept of controllability and observability and their testing.

Text Books:

1. Nagrath & Gopal, “Control System Engineering”, New age International.
2. K. Ogata, “Modern Control Engineering”, Pearson India.
3. B.C. Kuo & Farid Golnaraghi, “Automatic Control System” McGraw Hill, 2018.
4. D. Roy Choudhary, “Modern Control Engineering”, Prentice Hall of India.
5. Ambikapathy, “Control Systems”,Khanna Publishers

Reference Books:

1. Norman S. Mise, Control System Engineering, Wiley Publishing Co.
2. Ajit K Mandal, “Introduction to Control Engineering” New Age International.
3. R.T. Stefani, B.Shahian, C.J.Savant and G.H. Hostetter, “Design of Feedback Control Systems” Oxford University Press.
4. Samarjit Ghosh, “Control Systems theory and Applications”, Pearson Education

ELECTRICAL MACHINE-II
BTEE503

Course Outcomes: After completion of the course student will be able to:

1. Demonstrate the constructional details and principle of operation of three phase Induction and Synchronous Machines.
2. Analyze the performance of the three phase Induction and Synchronous Machines using the phasor diagrams and equivalent circuits.
3. Select appropriate three phase AC machine for any application and appraise its significance.
4. Start and observe the various characteristics of three phase Induction & Synchronous Machines
5. Explain the principle of operation and performance of Single-Phase Induction Motor & Universal Motor.

Unit 1 Synchronous Machine-I

Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O. C. & S. C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Voltage and frequency control (Governer system) of alternators , Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.

Unit 2 Synchronous Machine II

Two reaction theory, Transient and sub-transient reactance, Power flow equations of cylindrical and salient pole machines, Operating characteristics. Synchronous Motor - Starting methods, Effect of varying field current at different loads, V- curves, Hunting & damping, Synchronous condenser.

Unit 3 Three phase Induction Machine – I

Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque- slip characteristics, No load & blocked rotor tests, Efficiency.

Unit 4 Three phase Induction Machine- II

Starting, Deep bar and double cage rotors, Cogging & Crawling, Speed control (with and without emf injection in rotor circuit).

Unit 5 Single phase Induction Motor

Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, Repulsion motor, Universal motor.

Text Books:

1. I J Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

1. H. Cotton, "Electrical Technology", CBS Publication.
2. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
3. PS Bimbhra, " Generalized Theory.

POWER SYSTEM LABORATORY

BTEE506P

Pre-requisites of course: Basic understanding of Scilab/MATLAB/C/C++

Course Outcomes:

1. Use programming tools /Software: Scilab, MATLAB or any C, C++ - Compiler and formulate a program/simulation model for calculation of various parameters related to transmission line.

Note: Minimum ten experiments are to be performed from the following list, on a software platform preferably on Scilab, MATLAB, or any C, C++ - Compiler

1. Calculate the parameters of single-phase transmission line
3. Calculate the parameters of three phase single circuit transmission line
4. Calculate the parameters of three phase double circuit transmission line
5. Determine the ABCD constant for transmission line.
6. Simulate the Ferranti effect in transmission line
7. Calculate the corona loss of transmission line
8. Calculation of sag & tension of transmission line
9. Calculation of string efficiency of insulator of transmission line
10. Calculation for grading of underground cables
11. Simulate the skin effect in the transmission line
12. Calculation of ground clearance of transmission line
13. Calculate the parameters for underground cable.

Spoken Tutorial (MOOCs):

Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/)

CONTROL SYSTEM LABORATORY
BTEE507P

Pre-requisites of course: Basic understanding of Scilab/MATLAB or any equivalent open source software

Course Outcomes:

1. Determine the characteristics of control system components like ac servo motor, synchro, potentiometer, servo voltage stabilizer and use them in error detector mode.
2. Compare the performance of control systems by applying different controllers / compensators.
3. Analyze the behavior of dc motor in open loop and closed loop conditions at various loads & determine the response of 1^{st}& 2^{nd} order systems for various values of constant K.
4. Apply different stability methods of time & frequency domain in control systems using software & examine their stability.
5. Convert the transfer function into state space & vice versa & obtain the time domain response of a second order system for step input and their performance parameters using software.

Note: Minimum 10 experiments are to be performed from the following list:

1. To determine speed-torque characteristics of an AC servomotor.
2. To study

   Synchro Transmitter characteristics.

   Obtain Synchro Transmitter – Receiver output vs input characteristics.
3. To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical results.
4. To study characteristics of positional error detector by angular displacement of two servo potentiometers.
5. To simulate and compare the response of 2^{nd} order system with and without lead, lag, Lead-Lag compensator / simulate PID controller for transportation lag.
6. To study P, PI and PID temperature controller for an oven and compare their characteristics.
7. To study performance of servo voltage stabilizer at various loads using load bank.
8. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.

Software based experiments (Scilab/MATLAB or any equivalent open source software**)**

1. To determine time domain response of a second order system for step input and obtain performance parameters.
2. To convert transfer function of a system into state space form and vice-versa.
3. To plot root locus diagram of an open loop transfer function and determine range of gain 'k' for stability.

4. To plot a Bode diagram of an open loop transfer function.
5. To draw a Nyquist plot of an open loop transfers functions and examine the stability of the closed loop system.

Spoken Tutorial (MOOCs):

Spoken Tutorial MOOCs, ' Course on Scilab', IIT Bombay (http://spoken-tutorial.org/)

Reference Books:

5. K.Ogata,"Modern Control Engineering" Prentice Hall of India.

6. Norman S.Nise, "Control System Engineering", John Wiley & Sons.

7. M.Gopal, "Control Systems: Principles & Design" Tata McGraw Hill.

ELECTRICAL MACHINE-II LABORATORY

BTEE508P

Pre-requisites of course: Basic Electrical engineering Lab**,** Electrical Machine-I Lab.

Course Outcomes:

1. Perform various tests and demonstrate the various characteristics of three phase induction motor.
2. Demonstrate the working of three phase synchronous machine under different operating conditions.
3. Evaluate the performance of single-phase induction motor under different operating conditions.
4. Develop simulation models for Electrical Machines.

Note: Minimum 10 experiments are to be performed from the following list:

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor and determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw Torque -speed characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator.
6. To determine V-curves and inverted V-curves of a three phase synchronous motor.
7. To determine the direct axis reactance (Xd) and quadrature axis reactance (Xq) of synchronous machine.
8. To study synchronization of an alternator with the infinite bus by using: (i) dark lamp method (ii) two bright and one dark lamp method.
9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including resistance, or capacitance in the rotor circuit.
10. To determine speed-torque characteristics of single phase induction motor and study the effect of voltage variation.
11. To determine speed-torque characteristics of a three phase induction motor by (i) keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental data and determine voltage regulation at full load, and unity, 0.8 lagging and leading power factors.
13. To determine steady state performance of a three phase induction motor using equivalent circuit.

3. Load Test on Three Phase Alternator.

***The available experiments from above list may be performed on virtual lab on following virtual lab link::**

http://vlab.co.in/

ROBOTICS

BTEE504A

Course Outcomes: After completion of the course student will be able to:

1. Learn the basic terminology used in robotics.
2. Conceptualize 3-D translation & orientation of robot arm kinematics.
3. Understand different robotic actuators and power transmission systems.
4. Classify the types of robotic grippers used in automation industries.
5. Realization of robotic sensoric system and their interfacing with robot controller.

UNIT I: INTRODUCTION

Classifications of robots, Flexible automation vs. Robotic technology, Robot components and degree of freedom, Robot joints, coordinates and reference frames, characteristics of robots, Robot workspace, role of robots in Industry 4.0; Robot safety and social robotics.

UNIT II: KINEMATICS OF ROBOT

Matrix representation of robot kinematics, Transformation of matrix, Forward and Inverse Kinematics of robots, D-H Representation of Six Degree of Freedom Robot Arm.

UNIT III: ROBOT ACTUATORS AND POWER TRANSMISSION SYSTEMS

Characteristics of actuating systems, comparison of hydraulic, pneumatic and electrical actuating system, Mechanical transmission method (concept only) - Gear transmission, Belt drives, cables, Roller chains, Link-Rod systems, Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT IV: ROBOT GRIPPERS

Classification of End effectors, Drive system for grippers - Mechanical adhesive vacuum-magnetic-grippers. Hooks & scoops, Active and passive grippers.

UNIT V: ROBOT SENSORS, CONTROL HARDWARE AND INTERFACING

Sensor: Contact & Proximity, Position, Velocity, Force and Tactile, Introduction to Cameras, Vision applications in robotics; integration of robot controller with sensors, actuators & other supporting components.

TEXT BOOKS:

33. Saeed B. Niku, “Introduction to Robotics”, Pearson, 2011.
34. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010
35. John J.Craig , “Introduction to Robotics”, Pearson, 2009.
36. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

REFERENCES:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.

2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987

3. Spong & Vidyasagar, Robot Dynamics and Control, Mc Graw Hill

4. Subir K Saha, Robotics, Mc GrawHill

5. M. P. Groover, Ashish Dutta, Industrial Robotics, McGraw Hill

SENSORS AND TRANSDUCERS
BTEE504B

Pre-requisites of course: Basic Electrical Engineering, Basic signals & systems

Course Outcomes: After completion of the course student will be able to:

1. Understand the working of commonly used sensors in industry for measurement of displacement, force and pressure.
2. Recognize the working of commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.
3. Identify the application of machine vision.
4. Conceptualize signal conditioning and data acquisition methods.
5. Comprehend smart sensors and their applications in automation systems.

Unit- I:

Sensors & Transducer: Definition, Classification of transducers, Advantages and Disadvantages of Electrical Transducers; Measurement of displacement using Potentiometer, LVDT & Optical Encoder; Measurement of force using strain gauges & load cells; Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.

Unit-II:

Measurement of temperature using Thermistors, Thermocouples & RTD, Concept of thermal imaging; Measurement of position using Hall effect sensors; Proximity sensor: Inductive, Capacitive Photoelectric, Use of proximity sensor as accelerometer and vibration sensor; Flow Sensor: Ultrasonic & Laser; Level Sensor: Ultrasonic & Capacitive.

Unit -III:

Machine Vision: Introduction to machine vision, Difference between machine vision and computer vision; Imaging Sensors: CCD and CMOS; sensing & digitizing function in machine vision, image processing and analysis, training the vision system in a pick and place robot.

Unit-IV:

Signal Conditioning: Introduction, Functions of signal conditioning equipment, need for amplification of signals, Types of amplifiers. ta Acquisition Systems and Conversion: Introduction, Objectives & configuration of data acquisition system, Analog & Digital IO, Counters, Timers, need of data conversion.

Unit V:

Smart Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors:

Self calibration, Self-testing & self-communicating, Application of smart sensors: Smart city,

Industrial robots & electric vehicles.

Text Books:

2 DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013

3 D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.

4 S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.

2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques,PHI – 2001

3. Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition 2012, Oxford University Press.

INDUSTRIAL AUTOMATION & CONTROL

BTEE504C

Pre-requisites of course: Digital Electronics

Course Outcomes: After completion of the course student will be able to:

1. Understand the concept of automation, its terminology and basic communication protocol.
2. Apply Relay logic for automation.
3. Learn about PLC, its operation and application in automation.
4. Analyze the industrial sensors, its terminology and how one can interface with PLC.
5. Demonstrate Pneumatic system and its application in industry.

Unit1: Introduction of Automation system

Introduction to Industrial Automation, Requirement of automation systems, Application areas, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial communication protocols: modbus & profibus

Unit2: Automation using relay logic

Relay Circuits: Construction & Principle of Operation, Types of Relays, Relay as a memory element, Contactor Circuits, Advantages of Contactors over Relay, DOL circuit implementation using contactor, Automation problems based on relays, PLC Introduction: History & Current Trends, Basic Block Diagram of PLC, Classification of PLCs

Unit3: Automation using PLC

Types of PLC I/O: Analog and Digital, Sink and Source concept, PLC programming: Ladder diagram, Sequential flow chart, ladder programming, Timer instructions – On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, math instructions

Unit4: Industrial sensors and its application

Introduction to Industrial sensors: optical, inductive, capacitive Sensors, PNP and NPN senor concept, interfacing of sensors with PLC, 4-20 ma current loops, HART protocol, modes of HART protocol

Unit5: Basics of Pneumatics and its use in automation

Introduction to Pneumatics, Role in industries, Laws : Boyel's law, Charle's Law Bernoulli Equation, Humidity(Absolute & Relative) , Dew Point (ADP, PDP) Basic, Pneumatic System (Compressor, After coolers, Dryers, Air Tank, Service Unit (FRL), Actuators(single acting, double acting), Valves : 2/2 & 3/2 Valves ,Problems based on valves and actuator

Text Books:

8: Industrial Instrumentation and Control, by Singh, McGraw Hill.
9: Programmable Logic Controllers with Control Logix, by Jon Stenerson, Delmar Publishers, 2009
10: Webb John W. and Reis A. Ronald, "Programmable Logic Controllers Principles and Applications" PHI ,New Delhi, Latest edition
11: Bolton W, "Programmable Logic Controllers" Elsevier India Pvt. Ltd. New Delhi

Reference Books:

(vi) B. Pneumatic Systems-Principles and Maintenance Mazumdar S. R

(vii) John R Hackworth, "Programmable Logic Controllers" Pearson education New Delhi, Latest edition

ELECTRICAL STANDARDS AND ENGINEERING PRACTICES
BTEE504C

Pre-requisites of course: Basic Electrical Engineering, Electrical Machines and Power System

Course Outcomes: After completion of the course student will be able to:

1. Interpret different National & International Electrical Standards in practice
2. Understand Indian standards for cables, lighting and motors.
3. Understand Indian standards of transformers, LV & HV switchgears
4. Demonstrate the basic guidelines for National codes and design practices
5. Select the size and type of transformer, cable & switchgear for electrical applications.

Unit-I (Introduction of Standards and Design practices)

Different Electrical standards & codes, overview of Indian Standards and International Standards (IS, IEC, IEEE, NEMA and Building codes etc.).

General engineering design practices, selection of voltage level, role of electrical studies and design calculations (load flow, fault level calculation, earthing and lightning calculation, voltage drop) in distribution system planning. Feasibility study, thermal and electrical resistivity of soil, Study of electrical drawings/layouts and cost estimation.

Unit-II (Electrical Standards-I)

Overview of IS standards for cables (IS-7098 IS-8130, IS-10810, IS-1554, IS-1255), IS standards for lighting (IS-3646, IS-10322, IS-6665) and IS standards for motors (IS-325, IS-900, IS-2253, IS-4029, IS-15999) - basic terminologies, type test and routine tests.Efficiency class of motors as per IS/IEC standard.

Unit-III (Electrical Standards-II)

Transformer types, overview of IS standards for transformer (IS-2026, IS-6600 IS-10028, IS-11171), IS standards for LV & HV switchgears (IS-8623, IS/IEC-60898, IS/IEC-62271, IS-3427, IS-9920, IS-12729) - basic terminologies, type test and routine tests.

Instrument transformers (CT & PT), Instrument safety factor, VA burden, knee point voltage and accuracy classes.

Unit-IV (National Codes and Design practices)

Overview of National electrical code, National Building Code of India, Cable types, installation practices, de-rating factors and bonding methods, Earthing and lightning protection system, touch and step potentials, Hazardous area classification, electrical equipments for different hazardous zones.

Unit-V (Equipment Sizing & Selection, CEA Regulations)

Load estimation, sizing and selection of transformers, cables and switchgears, CEA Regulations 2010 and amendments, safety and installation guidelines.

Reference Books:

10. Robert Alonzo, "Electrical Codes, Standards, Recommended Practices and Regulations 1st Edition", Elsevier Inc.
11. Mohamed A El-Sharkawi, "Electric safety: practice and standards", CRC Press.
12. Central Electricity Authority Regulations and Amendments.

OPTIMIZATION TECHNIQUES
BTEE505A

Pre-requisites of course: Basic mathematics

Course Outcomes: After completion of the course student will be able to:

1. Understand the importance of optimization techniques in engineering applications
2. Learn optimization methods for solving linear programming problems
3. Learn optimization methods for solving nonlinear programming problems
4. Be aware of the concept of simulation and modern methods of optimization
5. Apply optimization techniques to electrical engineering problems

Unit I

Introduction to Optimization: Engineering application of Optimization, Statement of an optimizationproblem, Optimal problem formulation, Classification of optimization problem, Optimum design concepts: Definition of Global and Local optima using basic calculus concepts; Classical Optimization Techniques: Unconstrained Optimization - Single variable optimization, Constrained multivariable optimization with equality constraints - Lagrange multipliers method, Constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

Unit II

Linear Programming: Standard form of linear programming, Graphical solution, Simplex method, Big-Mmethod, Duality theory, Decomposition principle, Transportation problem using North-West Corner rule and Least cost rule.

Unit III

Non-Linear Programming: Standard form of non-linear programming, One–Dimensional Minimization Methods - Unimodal function, Dichotomous search, interval halving method; Unconstrained Optimization Techniques - Univariate method, Steepest descent method; Constrained Optimization Techniques – Interior Penalty function method, Exterior penalty function method.

Unit IV

Simulation: Definition, types of simulation, General process of simulation, advantages & disadvantages ofsimulation.

Project Management Techniques: PERT and CPM

Modern methods of Optimization: Genetic algorithm, working principle, fitness function, GA operators–crossover & mutation, comparison of GA with traditional methods.

Unit V

Case study (algorithm only): Economic load scheduling of power plant (without considering losses),maintenance scheduling of machines in manufacturing industry, fuzzy logic based speed control of DC machines.

Text Books:

3. S.S.Rao,"Optimization - Theory and Applications", Wiley-Eastern Limited.
4. D.E. Goldberg,"Genetic Algorithm in Search Optimization and Machine Learning ", Addision-Wesley Publication, 1989

5. Kwang Y. Lee, Mohamed A. El-Sharkawi, “Modern heuristic optimization techniques, Theory and applications to power systems”, Wiley-Interscience

Reference Books:

5. David G. Luenberger,"Introduction of Linear and Non-Linear Programming ", Wesley Publishing Company.
6. Polak,"Computational methods in Optimization ", Academic Press.
7. Pierre D.A., "Optimization Theory with Applications", Wiley Publications.
8. Kalyanmoydeb,"Optimization for Engineering Design: Algorithms and Examples", PHI Publication
9. L.P. Singh,"Advanced Power System Analysis and Dynamics ", Wiley Eastern Limited.
10. Olle I. Elewgerd " Electrical Energy System: An Introduction ", TMH Publication, New Delhi

NEURAL NETWORKS & FUZZY SYSTEMS

BTEE505B

Course Outcomes: After completion of the course student will be able to:

1. Apply the concepts of feed forward neural networks and their learning techniques.
2. Comprehend the architecture, develop algorithms and apply the concepts of back propagation networks.
3. Differentiate between the fuzzy and the crisp sets, apply the concepts of fuzziness and the fuzzy set theory.
4. Select the membership functions, write rules and develop the fuzzy controller for Industrial applications.
5. Demonstrate the working of fuzzy neural networks and identify its applications.

Unit-I: Neural Networks-1(Introduction & Architecture):

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

Unit-II: Neural Networks-II (Back propogation networks):

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.

Unit-III: Fuzzy Logic-I (Introduction):

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

Unit-IV: Fuzzy Logic –II (Fuzzy Membership, Rules):

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

Unit-V: Fuzzy Neural Networks:

L-R Type fuzzy numbers, fuzzy neutron, fuzzy back propogation (BP), architecture, learning in fuzzy BP, inference by fuzzy BP, applications.

Text Books:

12. Kumar Satish, “Neural Networks” Tata Mc Graw Hill
13. S. Rajsekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications” Prentice Hall of India.

Reference Books:

1. Siman Haykin, “Neural Netowrks” Prentice Hall of India
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India

DIGITAL SIGNAL PROCESSING

BTEE505C

Pre-requisites of course: Basic Signals & System, Network Analysis & Synthesis.

Course Outcomes: After completion of the course student will be able to:

1. Represent discrete sequence and LTI systems, frequency domain of discrete sequence. Compute Fourier transform. Draw structure of systems based on System type-IIR & FIR Systems.
2. Describe sampling of signal and its reconstruction, processing of continuous time and discrete time signals. Sampling rate variation and application of multirate signal processing. Sampling effect in A/D and D/A conversion.
3. Evaluate the response of LTI system and rational system function. Drive linear phase systems. Compute discrete Fourier transform (DFT) and calculate linear and circular convolution.
4. Design IIR & FIR filters with the desired specification with the help of impulse invariant and bilinear transformation method for IIR, with the help of window techniques for FIR. Design Butterworth and Chebyshev filter response.
5. Compute DFT using efficient algorithm like FFT in decimation in time and decimation in frequency both, using convolution property and Goertzel algorithm. Comparison between wavelet and Fourier transform. Application of WCT & DCT.

Unit-I:

Discrete-Time Signals and Systems:

Sequences, discrete time systems, LTI systems, frequency domain representation of discrete time signals and systems, discrete time signals and frequency domain representation, Fourier Transform.

Implementation of discrete time systems: Structure for FIR system, Structure for IIR systems

Unit-II:Sampling of Continuous Time Signals:

Sampling and reconstruction of signals, frequency domain representation of sampling, discrete time processing of continuous time signals, continuous time processing of discrete time signals, changing the sampling rate using discrete time processing, multi rate signal processing, digital processing of analog signals, over sampling and noise shaping in A/D and D/A conversion.

Unit-III:

Transform Analysis of LTI Systems:

Frequency response of LTI systems, system functions, frequency response for rational system functions, magnitude-phase relationship, all pass systems, minimum phase systems, and linear systems with generalized linear phase

Discrete Fourier Transform: Discrete Fourier Transform, properties, linear convolution and circular convolution,

Unit-IV: Filter Design Techniques:

Design of IIR filters using Impulse Invariant Response method and Bilinear Transformation method. utterworth filters and Chebyshev Filter's response, Design of FIR filters by windowing, Kaiser Window method, optimum approximations of FIR filters,

Unit-V:

Efficient computation of the DFT:

FFT algorithms- decimation in time and decimation in frequency, Goertzel algorithm, Implementation of the DFT using convolution,

Introduction to wavelet transform:

Wavelet comparison with Fourier transforms, Applications of Wavelet cosine transform, Discrete cosine transform (DCT).

Text Books:

1. S. Salivahanan, "Digital Signal Processing", McGraw Hill Education (India) Private Limited.
2. Oppenheim A.V., Schafer, Ronald W. & Buck, John R,"Discrete Time Signal processing", Pearson Education .

Reference Books:

1. Proakis, J.G. &Manolakis, D.G.," Digital Signal Processing: Principles Algorithms and Applications", Prentice Hall of India
2. Rabiner, L.R. and Gold B., "Theory and applications of DSP", Prentice Hall of India.
3. Oppenheim, Alan V. &Willsky, Alan S. , "Signals and Systems" , Prentice Hall of India, 2nd Edition
4. Johnson, J.R. , "Introduction to Digital Signal Processing", Prentice Hall of India.

ANALOG & DIGITAL COMMUNICATION
BTEE505D

Pre-requisites of course: Basic Signals & Systems.

Course Outcomes: After completion of the course student will be able to:

1. Understand the Amplitude Modulation in communication system.
2. Comprehend the Frequency & Phase modulation.
3. Realize the Pulse Modulation Techniques.
4. Get the Digital Modulation Techniques and their use in communication system.
5. Apply the concept of Information Theory in Communication Engineering.

UNIT I

Elements of communication system and its limitations, Amplitude modulation and detection, Generation and detection of DSB-SC, SSB and vestigial side band modulation, carrier acquisition AM transmitters and receivers, Superhetrodyne Receiver, IF amplifiers, AGC circuits, Frequency Division multiplexing.

Unit II

Angle Modulation: Basic definition, Narrow-Band and wideband frequency modulation, transmission bandwidth of FM signals, Generation and detection of frequency modulation, Generation and detection of Phase Modulation.

Noise: External noise, internal noise, noise calculations, signal to noise ratio.

Unit III

Pulse Modulation: Introduction, sampling process, Analog Pulse Modulation Systems, Pulse Amplitude Modulation (PAM), Pulse width modulation (PWM) and Pulse Position Modulation (PPM). Waveform coding Techniques: Discretization in time and amplitude, Quantization process, quantization noise, Pulse code Modulation, Differential Pulse code Modulation, Delta Modulation and Adaptive Delta Modulation.

Unit IV

Digital Modulation Techniques: Types of digital modulation, waveforms for amplitude, frequency and phase shift keying, coherent and non-coherent methods for the generation of ASK, FSK and PSK. Comparisons of above digital modulation techniques.

Unit V

Time Division Multiplexing: Fundamentals, Electronic Commutator, Bit/byte interleaving, TI carrier system, synchronization and signaling of TI, TDM and PCM hierarchy, synchronization techniques. Introduction to Information Theory: Measure of information, Entropy & Information rate, channel capacity, Hartley Shannan law, Huffman coding, shannan Fano coding.

Text Books:

1. Simon Haykin," Communication Systems" John Wiley & Sons 4th Edition
2. G.Kennedy and B. Davis," Electronic Communication Systems" 4th Edition, Tata McGraw Hill
3. Simon Haykin, "Digital Communications" John Wiley & Sons
4. T.L. Singal, "Analog & Digital Communication", Tata Mc Graw Hill

Reference Books:

1) B.P. Lathi, “Modern Analog & Digital Communication Systems” Oxford University Press.
2) Taub & Schilling, “Communication System: Analog and Digital” Tata Mc Graw Hill
3) R.P. Singh & S.D. Sapre, “Communication Systems Analog and Digital” Tata McGraw Hill.

(BTEE-509P) Mini Project or Internship Assessment*****

Semester -VI

POWER SYSTEMS-II
BTEE601

Pre-requisites of course: Basic Electrical Engineering, Networks Analysis and Synthesis, Electromagnetic Field Theory, Power System-I, Electrical Machines-II

Course Outcomes: After completion of the course student will be able to:

1. Identify power system components on one line diagram of power system and its representation including the behaviour of the constituent components and sub systems and Analyse a network under both balanced and unbalanced fault conditions and design the rating of circuit breakers.
2. Perform load flow analysis of an electrical power network and interpret the results of the analysis.
3. Describe the concept of travelling waves in transmission lines and use the travelling wave theory to determine the over voltage caused by surge propagation in transmission networks.
4. Assess the steady state and transient stability of the power system under various conditions.
5. Describe Operating Principle of a relay and classify them according to applications. Explain working principle of Circuit breaker and phenomenon of arc production and quenching.

UNIT-I (Fault Analysis in Power System):

One-line diagram, Impedance and reactance diagram, per unit system changing the base of per unit quantities, advantages of per unit system.

Symmetrical Components: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.

Fault Calculations: Fault calculations, sequence network equations, single line to ground fault, line to linefault, double line to ground fault, three phase faults, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus

UNIT-II (Load Flow Analysis):

Introduction, Formation of ZBUS and YBUS, development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, Comparison of Gauss Siedel and Newton Raphson Method, approximation to N-R method, fast decoupled method.

UNIT-III (Travelling Waves in Power System):

Travelling Waves on Transmission Lines: Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves, Bewley's Lattice diagram.

UNIT-IV (Stability in Power System):

Power flow through a transmission line, Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion. Factors affecting steady state and transient stability and methods of improvement.

UNIT-V (Introduction to Power System Protection):

Relays: Operating Principle of a general relay,

Basic Terminology: Relay, Energizing Quantity, setting, Pickup, drop out, Flag, fault clearing time, Relaytime, Breaker time, Overreach, Underreach; Classification of Relays according to applications, according to time. Overcurrent Relay, Distance Protection, Differential Protection.

Circuit Breakers: Arc Phenomenon, Arc Extinction and its Methods,Restriking Voltage & RecoveryVoltage, Circuit Breaker Rating.

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murthy, "Operation and control in Power Systems" B.S. Publications.
3. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill
4. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control " John Wiley & Sons.
5. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
6. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.

Reference Books:

5. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
6. P. Kundur, "Power System Stability and Control Mc Graw Hill.
7. T. K. Nagsarkar & M.S. Sukhija,' Power System Analysis' Oxford University Press.
8. Hadi Sadat, "Power System Analysis", Tata McGraw Hill.
9. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill

MICROPROCESSOR AND MICROCONTROLLER

BTEE602

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes: After completion of the course student will be able to:

1. Demonstrate the basic architecture of 8085 & 8086 microprocessors
2. Illustrate the programming model of microprocessors & write program using 8085 microprocessor
3. Interface different external peripheral devices with 8085 microprocessor
4. Comprehend the architecture of 8051 microcontroller
5. Compare advance level microprocessor & microcontroller for different applications

Unit- I:

Types of Microprocessor Architecture: Harward & Princeton.

Intel 8085 microprocessor: Internal architecture (ALU, System bus, Registers, Timing & control unit,Address/data bus de-multiplexing).

Intel 8086 microprocessor: Internal architecture (Bus Interface Unit, Execution unit, Pipelining, Registerorganization), Pin Diagram, Memory addressing, Physical memory organization, Interrupts (hardware & software interrupts)

Unit-II:

Fundamental of Programming: Program structure & programming techniques for microprocessors, 8085 Addressing modes, 8085 Instruction set, Assembly language programming of 8085 microprocessor with examples (arithmetic operations on 8-bit numbers – add, subtract, multiply, divide, square & square root etc, largest/ smallest number; ascending/ descending order).

Unit-III:

I/O Interface: 8255 PPI, architecture, various modes of operation & control words, interfacing of 8255 with8086.

Interfacing with I/O devices: Keyboard, display, stepper motor, D/A & A/D converter

Serial communication standards: Serial data transfer schemes, 8251 USART architecture & interfacing with8086.

Unit-IV:

Introduction to microcontrollers: 8051 microcontroller - internal architecture, signals, I/O ports, memoryorganization & interfacing, timing and control, port operations.

Unit-V:

8051 Real Time Control: 8051 timers and counters, interrupts in 8051. Comparison of Microprocessor, Microcontroller, PIC and ARM processors and their application areas.

Text Books:

1. Gaonkar, Ramesh S, "Microprocessor Architecture, programming and applications with the 8085" Pen ram International Publishing 5th Ed.

2. Avtar Singh & Walter A. Triebel “8088 & 8086 Microprocessor” Pearson Education.
3. Ray, A.K. & Burchandi, K.M., “Advanced Microprocessors and Peripherals: Architecture, Programaming and Interfacing” Tata Mc. Graw Hill.
4. AK Gautam, “Advanced Microprocessors”, Khanna Publishers.
5. 8051 Microcontroller – K. Ayala (Cengage learning)

Reference Books:

13. Brey, Barry B. “INTEL Microprocessors” Prentice Hall (India)
14. Aditya P Mathur, “Introduction to Microprocessor” Tata McGraw Hill
15. M. Rafiquzzaman, “Microprocessors- Theory & applications”, Pearson India.
16. B. Ram, “Advanced Microprocessor & Interfacing” Tata McGraw Hill
17. Liu and Gibson G.A., “Microcomputer Systems: The 8086/8088 Family Architecture Programming & Design” Pearson India.
18.Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan (Oxford university press)

POWER ELECTRONICS
BTEE604

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes: After completion of the course student will be able to:

1. Demonstrate the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications.
2. Comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.
3. Analyze the phase controlled rectifiers and evaluate their performance parameters.
4. Apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications.
5. Explain the single-phase and three phase bridge inverters differentiate between CSI and VSI and apply PWM for harmonic reduction.

Unit-I: Power semiconductor devices:

Introduction: Concept of Power Electronics, scope and applications, desired Characteristics ofcontrollable switches

Power semiconductor switches and their characteristics: Power Diode, Power BJT, PowerMOSFET, IGBT, SCR, TRIAC, GTO.

Unit-II:

Thyristor: Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series andParallel operation.

DC-DC Converters:Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boostconverter, Analysis of buck converter, Switched Mode power Supply (SMPS).

Unit-III: Phase Controlled Converters:

Single phase half wave controlled rectifier with various loads, Effect of freewheelingdiode, Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters, three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters

Unit-IV: AC Voltage Controllers:

Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter.

Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to singlephase output voltage equation.

Unit-V: Inverters:

Single phase and Three phase bridge inverters, voltage source inverters, current source inverters, Voltage control of single phase inverters, Pulse width modulation, Introduction to Multi level inverter.

Text Books:

5. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India
6. Ltd. 3rd Edition,2004.
7. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics:Converters, Applications
8. and Design", Wiley India Ltd,2008
9. P.C. Sen, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd.
10. P.S. Bhimbra, "Power Electronics", Khanna Publishers.

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004

    3. Chakrabarti&Rai, "Fundamentals of Power Electronics &Drives"DhanpatRai& Sons.

4. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications" Oxford
5. University Press,2007
6. S.N.Singh, "A Text Book of Power Electronics" DhanpatRai& Sons

POWER SYSTEM LAB-II
(BTEE-606P)

Pre-requisites of course: Power System-I Lab

Course Outcomes: After completion of the course student will be able to:

1. Test various relays for different characteristics and compare with the performance characteristics provided by manufacturers.
2. Select the power system data for load-flow and fault studies and to develop a program to solve power flow problem using NR and GS methods
3. Analyze various types of short circuit faults
4. Demonstrate different numerical integration methods and factors influencing transient stability
5. Determine the effect of load in long transmission line

Note: - Minimum 10 experiments are to be performed from the following list:

(A) Hardware Based Experiments:

1. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
2. To Study the over-current relay and the effect of PSM and TSM.
3. To study percentage differential relay.
4. To study Impedance, MHO and Reactance type distance relays and zones of protection.
5. To study Ferranti effect of a transmission line/cable.
6. To measure the dielectric Strength of transformer oil.
7. To study the Synchronization of alternator with infinite bus bar.
8. To determine positive sequence, negative sequence and zero sequence reactance of an alternator.
9. To Study the effect of different shape of electrodes on dielectric (air) breakdown.
10. To Study the gas actuated Buchholz relay for oil filled transformer.
11. To determine the sub-transient (xd″), transient (xd′) and steady state reactance (xd) of asynchronous machine.

• **The available Experiments from above list may be performed on virtual lab on following virtual lab link:**

http://vlab.co.in/

- **Simulation Based Experiments (using Scilab/MATLAB or any other equivalent open source software platform)**

6. To obtain formation of Y-bus.
7. Perform load flow analysis on a 3- Bus System using G-S Method.

8. Perform load flow analysis on a 3- Bus System using N-R Method.
9. To perform symmetrical fault analysis in a power system.
10. To perform unsymmetrical fault analysis in a power system.
11. Swing Curve by Step-by-Step Method.
12. Determination of the stability of a SMIB system in occurrence of a fault by solving the Swing equation by Euler's Method.

Text Books: -

5. Haadi Sadat, "Power System Analysis" Tata McGraw Hill.
6. T.K. Nagsarskar & M.S. Sukhija, Power System Analysis' Oxford University Press.
7. K. Umarao, "Computer Techniques and Models in Power System", Wiley

MICROPROCESSOR AND MICROCONTROLLER LAB

(BTEE-607P)

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes: After completion of the course student will be able to:

1. Study of microprocessor system
2. Development of flow chart for understanding the data flow
3. Learning assembly language to program microprocessor based system
4. Interfacing different peripheral devices with the microprocessor
5. Building logic for microprocessor based system

Note: Minimum ten experiments are to be performed from the following list (on 8085 / 8086microprocessor)

4. To study 8085 / 8086 based microprocessor system

5. To perform mathematical operations (addition & subtraction) on two 8-bit numbers

6. To perform multiplication on two 8-bit numbers

7. To perform division on two 8-bit numbers

8. To develop and run a program for finding out the largest number from given two 8-bit numbers

9. To develop and run a program for finding out the smallest number from given two 8-bit numbers

10. To develop and run a program for arranging in ascending order of a given set of 8-bit numbers

11. To develop and run a program for arranging in descending order of a given set of 8-bit numbers

12. To perform conversion of temperature from degree F to degree C

13. To perform computation of square root of a given number

14. To obtain interfacing of 8255 – PPI with 8085 microprocessor

15. To perform microprocessor based traffic light control

16. To perform microprocessor based stepper motor operation through 8085 / 8086 kit

17. To obtain interfacing of DMA controller with 8085 / 8086 microprocessor

POWER ELECTRONICS LABORATORY

(BTEE-608P)

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes: After completion of the course student will be able to:

1. Demonstrate the characteristics and triggering of IGBT, MOSFET, Power transistor and SCR.
2. Analyze the performance of single phase fully controlled bridge rectifiers under different loading conditions.
3. Develop simulation models of power electronic circuits.

Note: Minimum 10 experiments are to be performed from the following list:.

7. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor

8. To study V-I characteristics of SCR and measure latching and holding currents.

9. To compare the R, RC & UJT trigger circuit for SCR.

10. To study the commutation circuit for SCR.

11. To study single phase fully controlled bridge rectifiers with resistiveand inductive loads.

12. To study single phase fully controlled bridge rectifiers with DC motor load.

13. To study three-phase fully controlled bridge rectifier with resistive and inductive loads.

14. To study single-phase ac voltage regulator with resistive and inductive loads.

15. To study single phase cyclo-converter

16. To study the four quadrant operation of chopper circuit

17. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (Scilab/MATLAB or any equivalent open source software)

1. To obtain the simulation of single phase half wave controlled rectifier with R and RL load and plot load voltage and load current waveforms.
2. To obtain simulation of single phase fully controlled bridge rectifier and plot load voltage and load current waveform for inductive load.
3. To obtain simulation of single phase full wave ac voltage controller and draw load voltage

andload current waveforms for inductive load.

4. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in output voltage and load current.

Text/Reference Books:

1. M.H.Rashid, "Power Electronics: Circuits, Devices and Applications", 3rd Edition, prentice Hall of India.2. D
2. .W. Hart, "Introduction to power Electronics" Prentice hall Inc.

SPECIAL ELECTRICAL MACHINES

(BTEE-604A)

Pre-requisites of course: Electrical Machines-I & Electrical Machines-II.

Course Outcomes: After completion of the course student will be able to:

1. Describe the working principle, Constructional Features of different types of electrical machines including the fractional kilowatt machines.
2. Analyse torque- speed characteristics of different electrical machines and interpret their performance and identify the suitable machine for an operation.
3. Study different types of control techniques for a machine and identify the best control strategy based upon different constraints.
4. Illustrate the use of stepper, BLDCs, SRM, and other special machines in the area of the various industrial and domestic as well as commercial applications of various fractional kilowatt machines.

Unit-I: Induction Machines: Concept of constant torque and constant power controls, SEIG, DFIG:Operating Principle, Equivalent Circuit, Characteristics, Applications, Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications.

Unit-II: Stepper Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybridmotor, Single and multistack configurations, Torque equations, Characteristics, Drive circuits, Microprocessor control of stepper motors, Closed loop control, Applications.

Unit-III: Switched Reluctance Motors: Constructional features, Rotary and Linear SRM, Principle ofoperation, Torque production, performance characteristics, Methods of Rotor position sensing, Sensor less operation, Closed loop control and Applications

UNIT-IV Permanent Magnet Machines: Permanent Magnet synchronous generator Operating Principle,Equivalent Circuit, Characteristics, Permanent magnet DC motors, sinusoidal PMAC motors, their important features and applications, PCB motors,

Permanent Magnet Brushless D.C. Motors: Principle of operation, Types, Magnetic circuit analysis, EMFand torque equations, Commutation, Motor characteristics and control, Applications.

UNIT-V: Single phase synchronous motor; construction, operating principle and characteristics ofreluctance and hysteresis motors;

Single Phase Commutator Motors: Construction, principle of operation, characteristics of universal andrepulsion motors;

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

2. T.J.E Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford,

3. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.

Reference Books:

6. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

7. M.G. Say "Alternating current Machines" Pitman & Sons.

ELECTRICAL MACHINE DESIGN
(BTEE-604B)

Pre-requisites of course: Electrical Machine-I & Electrical Machine-II.

Course Outcomes: After completion of the course student will be able to:

1. Classify insulating materials for electrical machines and calculate mmf and magnetizing current.
2. Design the core, yoke, windings and the cooling system of a transformer.
3. Illustrate the core and armature design of DC and 3-phase synchronous machine. Design design of three phase induction motors, field system of DC machine and synchronous machines.
4. Analyse computer aided design approaches and apply the concepts of of optimization for the design of transformer, dc machine, three phase induction and synchronous machines.

UNIT-I

Basic Considerations: Basic concept of design, limitation in design,standardization, modern trends in design and manufacturing techniques, Classification of insulating materials. Calculation of total mmf and magnetizing current.

UNIT-II

Transformer Design: Output equation, design of core, yoke and windings, overalldimensions, Computation of no load current to voltage regulation, efficiency and cooling system designs.

UNIT-III:

Design of rotating machines – I: Output equations of rotating machines, specificelectric and magnetic loadings, factors affecting size of rotating machines, separation of main dimensions, election of frame size, Core and armature design of dc and 3-phase ac machines

Unit-IV:

Design of rotating machines – II: Rotor design of three phase induction motors,Design of field system of DC machine and synchronous machines. Estimation of performance from design data.

Unit-V:Computer Aided Design: Philosophy of computer aided design, advantages andlimitations. Computer aided design approaches analysis, synthesis and hybrid methods. Concept of optimization

and its general procedure. Flow charts and ‘c’ based computer programs for the design of transformer, dc machine, three phase induction and synchronous machines

Text Books:

9. K. Sawhney, “A Course in Electrical Machine Design” Dhanpat Rai & Sons.
10. K.G. Upadhyay,“ Conventional and Computer Aided Design of Electrical Machines” Galgotia Publications.

Reference Books:

9. M.G. Say, “The Performance and Design of AC Machines” Pitman & Sons.
10. A.E. Clayton and N.N. Hancock, “The Performance and Design of D.C.Machines” Pitman & Sons.
11. S.K. Sen, “Principle of Electrical Machine Design with Computer Programming” Oxford and IBM Publications.

DIGITAL CONTROL SYSTEM
(BTEE-604C)

Pre-requisites of course: Control System

Course Outcomes: After completion of the course student will be able to:

1. Represent discrete time systems under the form of z-domain transfer functions and state-space models.
2. Obtain the model of discrete-time systems by pulse transfer function.
3. Analyze stability, transient response and steady state behaviour of linear discrete- time systems, analytically and numerically using tools such as MATLAB and Simulink
4. Design sampled data control systems.
5. Describe Discrete state space model and test controllability and observability of systems.

Unit 1: Introduction to digital control

Introduction, Discrete time system representation, Mathematical modelling of sampling process, Data reconstruction.

Unit 2: Modelling discrete-time systems by pulse transfer function

Revisiting Z-transform, Mapping of s-plane to z-plane, Pulse transfer function, Pulse transfer function of closed loop system, Sampled signal flow graph.

Unit 3: Stability analysis of discrete time systems

Jury stability test, Stability analysis using bi-linear transformation. Time response of discrete systems:Transient and steady state responses, Time response parameters of a prototype second order system.

Unit 4: Design of sampled data control systems:

Root locus method, Controller design using root locus, Root locus-based controller design using MATLAB, Nyquist stability criteria, bode plot, Lead compensator design using Bode plot, Lag compensator design using Bode plot, Lag-lead compensator design in frequency domain.

Unit 5: Discrete state space model

Introduction to state variable model, Various canonical forms, Characteristic equation, state transition matrix,

Solution to discrete state equation. Controllability, observability and stability of discrete state space models:

Controllability and observability, Stability, Lyapunov stability theorem.

References:

1. B. C.Kuo, Digital Control Systems, Oxford University Press, 2/e, Indian Edition, 2007.
2. K. Ogata, Discrete Time Control Systems,Prentice Hall, 2/e, 1995.

3. M. Gopal, Digital Control and State Variable Methods, Tata Mcgraw Hill, 2/e, 2003.

4. G. F. Franklin, J. D.Powell and M. L. Workman, Digital Control of Dynamic Systems, Addison Wesley, 1998, Pearson Education,Asia, 3/e, 2000.

5. K. J.Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design,Prentice Hall, 3/e, 1997.

ELECTRIC AND HYBRID VEHICLES
(BTEE-604D)

Pre-requisites of course: Electrical Machines, Power Electronics

Course Outcomes: After completion of the course student will be able to:

1. Choose a suitable drive scheme for developing an electric hybrid vehicle depending on resources
2. Design and develop basic schemes of electric vehicles and hybrid electric vehicles.
3. Choose proper energy storage systems for vehicle applications
4. Identify various communication protocols and technologies used in vehicle networks.

Unit1:

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social andenvironmental importance of hybrid and electric vehicles.

Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization,transmission characteristics, mathematical models to describe vehicle performance.

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybriddrive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-traintopologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit2: Electric Propulsion unit:

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

Unit3: Energy Storage:

Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

Unit4: Sizing the drive system:

Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems

Unit5: Energy Management Strategies:

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

Reference Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
2. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004

Real Time Systems
BTOE-605A

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Describe concepts of Real-Time systems and modeling.
2. Recognize the characteristics of a real-time system in context with real time scheduling.
3. Classify various resource sharing mechanisms and their related protocols.
4. Interpret the basics of real time communication by the knowledge of real time models and protocols.
5. Apply the basics of RTOS in interpretation of real time systems.

Unit	Topics	Lectures
I	**Introduction** Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	**8**
II	**Real Time Scheduling** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	**8**
III	**Resources Sharing** Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.	**8**
IV	**Real Time Communication** Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority- Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.	**8**
V	**Real Time Operating Systems and Databases** Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.	**8**

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Embedded System
BTOE-605B

Course Objectives: After completion of the course student will be able to:

1. Attain the knowledge of embedded system and its development environment.
2. Gain the knowledge of RTOS based embedded system design and its applications.

Course Outcomes: After completion of the course student will be able to:

1. Understand the basics of embedded system and its structural units.
2. Analyze the embedded system specification and develop software programs.
3. Evaluate the requirements of the programming embedded systems, related software architecture.
4. Understand the RTOS based embedded system design.
5. Understand all the applications of the embedded system and designing issues.

Unit	Topic	Lectures
1	Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging. Embedded Networking: Embedded Networking: Introduction, I/O Device Ports &	**8**
2	Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers. Embedded Firmware Development Environment: Embedded Product Development	**8**
3	Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model. RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication	**8**
4	shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, ЧC/OS-II, RT Linux. Embedded System Application Development: Design issues and techniques Case	**8**
5	Study of Washing Machine- Automotive Application- Smart card System Application.	**8**

Text Books:

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design” Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.
3. Steve Heath, “Embedded System Design”, Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, “The 8051.
5. Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007.

Introduction to Mems
BTOE-605C

Course Objectives: After completion of the course student will be able to:

1. Understand the Basic concept of MEMS, Mechanics of Beam and Diaphragm Structures, Air Damping and Electrostatic Actuation.
2. Know the knowledge of Thermal Effects and the Applications of MEMS in RF.

Course Outcomes: After completion of the course student will be able to:

1. Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.
2. Explain Mechanics of Beam and Diaphragm Structures.
3. Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
4. Know the concept of Electrostatic Actuation.
5. Understand the applications of MEMS in RF

Unit	Topic	Lectures
1	**Introduction to MEMS:** MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors / Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.	8
2	**Mechanics of Beam and Diaphragm Structures:** Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.	8
3	**Air Damping:** Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	8
4	**Electrostatic Actuation:** Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	8

5	**Thermal Effects:** Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors. **Applications of MEMS in RF** MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Micro resonator Modeling, Micromechanical Resonator Limitations.	**8**

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.
2. S.M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, "Sensors and Transducers", McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, "Micro sensors", IEEE Press.

Object Oriented Programming
BTOE-605D

Course Objectives: After completion of the course student will be able to:

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Know the knowledge of Basic Structural Modeling, Object Oriented Analysis and C++ Basics.

Course Outcomes: After completion of the course student will be able to:

1. Understand the Basic concept of Object Orientation, object identity and Encapsulation.
2. Understand the Basic concept of Basic Structural Modeling.
3. Know the knowledge of Object oriented design, Object design.
4. Know the knowledge of C++ Basics.
5. Understand the Basics of object and class in C++.

Unit	Topic	Lectures
1	hiding, polymorphism, generosity, importance of modelling, principles of modelling, object oriented modelling, Introduction to UML, conceptual model of the UML, Architecture.	**8**
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class &Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration Diagrams, iterated messages, use of self in messages. Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, call-back mechanism, broadcast messages. Basic Behavioural Modeling: Use cases, Use case Diagrams, Activity Diagrams, State Machine , Process and thread, Event and signals, Time diagram, interaction diagram, Package diagram. Architectural Modeling: Component Deployment, Component diagrams and Deployment diagrams	**8**
3	Object Oriented Analysis: Object oriented design, Object design, Combining three models, Designing algorithms, design optimization, Implementation of control, Adjustment of inheritance, Object representation, Physical packaging, Documenting design considerations. Structured analysis and structured design (SA/SD), Jackson Structured Development (JSD).Mapping object oriented concepts using non-object oriented language, Translating classes into data structures, Passing arguments to methods, Implementing inheritance,	**8**

Unit	Topic	Lectures
	associations encapsulation. Object oriented programming style: reusability, extensibility, robustness, programming in the large. Procedural v/s OOP, Object oriented language features. Abstraction and Encapsulation.	
4	C++ Basics : Overview, Program structure, namespace, identifiers, variables, constants, enum, operators, typecasting, control structures C++ Functions : Simple functions, Call and Return by reference, Inline functions, Macro Vs. Inline functions, Overloading of functions, default arguments, friend functions, virtual functions	**8**
5	Objects and Classes : Basics of object and class in C++, Private and public members, static data and function members, constructors and their types, destructors, operator overloading, type conversion. Inheritance : Concept of Inheritance, types of inheritance: single, multiple, multilevel, hierarchical, hybrid, protected members, overriding, virtual base class Polymorphism : Pointers in C++, Pointes and Objects, this pointer, virtual and pure virtual functions, Implementing polymorphism	**8**

Text Books:

1. James Rumbaugh et. al, "Object Oriented Modeling and Design", PHI
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education
3. Object Oriented Programming with C++, E Balagurusamy, TMH

Reference Books:

1. R. S. Salaria, Mastering Object Oriented Programming with C++, Khanna Publishing House.
2. C++ Programming, Black Book, Steven Holzner, dreamtech.
3. Object Oriented Programming in Turbo C++, Robert Lafore, Galgotia.
4. Object Oriented Programming with ANSI and Turbo C++, Ashok Kamthane, Pearson.
5. The Compete Reference C++, Herbert Schlitz, TMH.
6. C++ and Object Oriented Programming Paradigm, PHI.
7. C++ : How to Program, 9th Edition, Deitel and Deitel, PHI.

Numerical Techniques
BTOE-605E

Course Objective: Students undergoing this course are expected to-

1. Understand about the basics of numerical techniques and its applications to Engineering Problems.

Course Outcomes: After completion of the course student will be able to-

1. Understand about the basics of Ordinary Differential Equations, Separable equations, Equations made separable by change of variables.
2. Retrieve the information content of Power series method.
3. CO3: Apply problem specific Bessel's equation, Bessel Functions to engineering applications.
4. Understand about the basics of matrix, Eigen values and eigen vectors.
5. Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid-Liquid Extraction.

Unit	Topic	Lectures
1	Ordinary Differential Equations, Separable equations, Equations made separable by change of variables, Homogeneous Equations, Equations with first order and first degree with linear coefficients, Exact equations, Linear equation of first order, Bernoulli's equation, Other degree, Clairaut's equation, Singular solutions, Equations with missing terms, General properties of Linear equations, Linear equations with constant coefficients, Determination of the complementary function, exponential functions, Determination of the particular integral, the Euler equation, Simultaneous Linear Differential equations.	**8**
2	Power series method, theory of the power series method, Legendre's equation, Legendre's Polynomials, Frobenius Method.	**8**
3	Bessel's equation, Bessel Functions $Jv(x)$, Bessel Functions $Jv(x)$ for any $v \geq 0$. Gamma Function, Solution $J\text{-}v(x)$ of the Bessel Equation, Backbones of Bessel's Theory, $Jv(x)$ with $v = \pm 1/2, \pm 3/2, \pm 5/2$.	**8**
4	Definition of matrix, Some special definitions and operations involving matrices, Determinants, Theorems on determinants, Inverse of a matrix, Orthogonal and unitary matrix. Orthogonal vectors, System of linear	**8**

Unit	Topic	Lectures
	equations, Systems on n equations with n unknowns, Cramer's Rule, Eigen values and eigen vectors.	
5	Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction, Solution of Difference Equations, Stirred-Tank Reactor System Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.	**8**

Text & Reference books:

1. Mickley, Reid and Sherwood, "Applied Mathematics in Chemical Engineering", Tata McGraw Hill, New Delhi (1981).
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley and Sons (1999).
3. M. R. Spiegel, "Advanced Mathematics for Engineers and Scientists", Schaum Outline Series, McGraw Hill, (1971).
4. Chandrika Prasad, Reena Garg, "Advanced Engineering Mathematics", Khanna Publishing house

Gis & Remote Sensing
BTOE-605F

Course Objective: Students undergoing this course are expected to-

1. Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Outcomes: *After completion of the course student will be able to-*

1. Understand about the principles of Remote Sensing and its advantages and limitations.
2. Retrieve the information content of remotely sensed data.
3. Apply problem specific remote sensing data for engineering applications.
4. Analyze spatial and attribute data for solving spatial problems.
5. Create GIS and cartographic outputs for presentation

Unit	Topic	Lectures
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	**8**
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation-interpretation elements;	**8**
3	Photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions;	**8**

Unit	Topic	Lectures
	analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	**8**
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	**8**

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.
3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

Understanding the Human Being Comprehensively – Human Aspirations and its Fulfillment
BTOE-605G

Course Objectives:

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.
2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.
3. To help the students to develop the understanding of human tradition and its various components.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

Unit	Topic	Lectures
1	**Introduction:** The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	**8**
2	**Understanding Human being and its expansion:** The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – in interconnectedness and co-existence; and finally understanding the role of human being in ence (human conduct).	**8**
3	**Activities of the Self:** Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	**8**
4	**Understanding Co-existence with other orders:** The need and the process of inner evolution (through self-exploration, selfawareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	**8**
5	**Expansion of harmony from self to entire existence:** Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	**8**

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

Electric Drives
(BTEE701)

Pre-requisites of course: Electrical Machine, Network Analysis & Synthesis

Course Outcomes: After completion of the course student will be able to:

1. Demonstrate the characteristics of Electric Drives and its parts
2. Determination of motor power rating for continuous duty, short time duty and intermittent duty
3. Analyze the Electric Braking and its Purpose and types of electric braking,
4. Understand the Power Electronic Control of AC Drives Three Phase induction Motor Drive
5. Explain the Three Phase induction Motor Drive and Static Voltage control schem

UNIT-I:
Fundamentals of Electric Drive:Electric Drives and its parts, advantages of electric drives, Classification of electric drives, Speed-torqueconventions and multi-quadrant operations, Constant torque and constant power operation, Types of load,Load torque: components, nature and classification.

UNIT-II
Dynamics of Electric Drive:Dynamics of motor-load combination, Steady state stability of Electric Drive, Transient stability of electricDriveSelection of Motor Power rating:Thermal model of motor for heating and cooling, classes of motor duty, determination of motor power ratingfor continuous duty, short time duty and intermittent duty., Load equalization

UNIT-III
Electric Braking:Purpose and types of electric braking, braking of dc, three phase induction and synchronous motorsDynamics During Starting and Braking: Calculation of acceleration time and energy loss during starting ofdc shunt and three phase induction motors, methods of reducing energy loss during starting. Energy relationsduring braking, dynamics during braking.

UNIT-IV
Power Electronic Control of DC Drives:Single phase and three phase-controlled converter fed separately excited dc motor drives (continuousconduction only), dual converter fed separately excited dc motor drive, rectifier control of dc series motor.Supply harmonics, power factor and ripples in motor current Chopper control of separately excited dc motorand dc series motor.

UNIT-V
Power Electronic Control of AC Drives:Three Phase induction Motor Drive: Static Voltage control scheme, static frequency control scheme (VSI,CSI, and cyclo – converter based) static rotor resistance and slip power recovery control schemes.Three Phase Synchronous motor: Self-controlled schemeSpecial Drives: Switched Reluctance motor, Brushless dc motor. Selection of motor for particularapplications

Text Books:

1. G.K. Dubey, “Fundamentals of Electric Drives”, Narosa publishing House.
2. S.K.Pillai, “A First Course on Electric Drives”, New Age International.
3. V Subrahmanyam, “Electric Drives”, Mcgrawhill Education

Reference Books:

1 M.Chilkin, “Electric Drives”,Mir Publishers, Moscow.
2 Mohammed A. El-Sharkawi, “Fundamentals of Electric Drives”, Thomson Asia, Pvt. Ltd. Singapore.
3 N.K. De and Prashant K.Sen, “Electric Drives”, Prentice Hall of India Ltd.

ELECTRIC DRIVES-Lab
(BTEE705P)

Pre-requisites of course: Power System-I Lab

Course Outcomes: After completion of the course student will be able to:

1. Test various speed control of dc motor
2. Demonstrate the various speed control of A.C. Induction Motor
3. Analyze various types Regenerative / Dynamic braking operation for DC Motor –
4. Demonstrate different speed control methods
5. Analyze the speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.

Note: - Minimum 10 experiments are to be performed from the following out of which at least three should be software based.

1. To study speed control of separately excited dc motor by varying armature voltage using single phase fully controlled bridge converter.
2. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.
3. To study speed control of separately excited dc motor using single phase dual converter (Static Ward-Leonard Control)
4. To study speed control of separately excited dc motor using MOSFET/IGBT chopper
5. To study closed loop control of separately excited dc motor
6. To study speed control of single phase induction motor using single phase ac voltage controller.
7. To study speed control of three phase induction motor using three phase ac voltage controller
8. To study speed control of three phase induction motor using three phase current source inverter
9. To study speed control of three phase induction motor using three phase voltage source inverter
10. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper
11. Regenerative / Dynamic braking operation for DC Motor - Study uses software.
12. Regenerative / Dynamic braking operation of AC motor - study uses software.
13. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
14. To study speed control of three phase induction motor using (a) constant/V/F control (b) Constant Voltage and frequency control.
15. VSI / CSI fed Induction motor Drive analysis using MATLAB / SPICE / PSIM Software.
16. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.

Utilization of Electrical Energy and Traction
(BTEE702A)

Pre-requisites of course: Basic Electrical Engineering, Electrical

Course Outcomes: After completion of the course student will be able to:

1. Analyze the methods of electric heating,
2. Obtain the performance o f speed time curve and its simplification
3. Demonstrate thevarious Illumation techniques
4. Demonstrate procedures and analysis of energy saving Power Electronic control of dc and ac traction drives .

Unit-I:
Electric Heating: Advantages and methods of electric heating, Resistance heating, Electric arc heating, Induction heating, Dielectric heating

Unit-II:
Electric Welding: Electric Arc Welding Electric Resistance Welding Electronic welding control Electrolyte Process: Principles of electro deposition, Laws of electrolysis, applications of electrolysis

Unit-III:
Illumination:Various definitions, Laws of illumination, requirements of good lighting Design of indoor lighting and outdoor lighting systems Refrigeration and Air Conditioning: Refrigeration systems, domestic refrigerator, water cooler Types of air conditioning, Window air conditioner

Unit-IV: Electric Traction – ITypes of electric traction, systems of track electrification Traction mechanics- types of services, speed timecurve and its simplification, average and schedule speeds Tractive effort, specific energy consumption,mechanics of train movement, coefficient of adhesion and its influence

Unit-V: Electric Traction – II
Salient features of traction drives Series – parallel control of dc traction drives (bridge transition) and energysaving Power Electronic control of dc and ac traction drives Diesel electric traction.

Text Books:
1. H. Partab, "Art and Science of Electrical Energy" Dhanpat Rai & Sons.
2. G.K. Dubey, "Fundamentals of Electric Drives" Narosa Publishing House
Reference Books:
3. H. Partab, " Modern Electric Traction" Dhanpat Rai & Sons.
4. C.L. Wadhwa, " Generation, Distribution and Utilization of Electrical Energy" New Age International
Publications.

Introduction to Smart Grid
(BTEE702B)

Pre-requisites of course: Basic Electrical Engineering, Electrical

Course Outcomes: After completion of the course student will be able to:

1. Study the concept of Electric grid and smart frid
2. Analyze the Smart Grid Technologies
3. Analyze smart substations
4. Demonstrate procedures and analysis of Power Quality Management in Smart Grid

Unit-I:
Introduction: Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Unit-II: Smart Grid Technologies: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.

Unit-III: Smart Grid Technologies: Smart Substations, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.

Unit-IV: Microgrids and Distributed Energy Resources: Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin flim solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.

Unit V: Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.

Text Books:
1. Ali Keyhani, Mohammad N. Marwali, Min Dai, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press.
3. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
4. Jean Claude Sabonnadiere, NouredineHadjsaid, "Smart Grids", Wiley Blackwell 19.
5. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press.
Reference Books:
6. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability",

Artech House Publishers July 2011.
7. James Northcote, Green, Robert G. Wilson “Control and Automation of Electric Power Distribution Systems (Power Engineering)”, CRC Press.
8. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert “Substation Automation (Power Electronice and Power Systems)”, Springer
9. R.C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication.

Computer Aided Power System Analysis
(BTEE702C)

Pre-requisites of course: Basic Electrical Engineering, Electrical

Course Outcomes: After completion of the course student will be able to:

1. Study the concept of Modern Power Systems Operation and Control
2. Analysis of Faulted Power System
3. Analyze Security Analysis
4. Stability Analysis: Classification of Power System

UNIT-I:
Introduction: Modern Power Systems Operation and Control, Different types of Power System Analysis. AC Power Flow Analysis: Introduction, Modeling of Power System Components, Power Flow Equations, Formation of Ybus Matrix, Power Flow Solution Algorithms, Newton Raphson Load Flow Method, Fast Decoupled Load Flow Method and DC Load Flow Method, AC-DC System Power Flow Analysis- Sequential and Simultaneous Solution Algorithms

UNIT-II:
Sparse Matrices: Sparsity directed Optimal Ordering Schemes, Solution Algorithms – LU factorization, Bi-factorization and Iterative Methods.

UNIT –III:
Analysis of Faulted Power System: Symmetrical and Asymmetrical Faults, Zbus Formulation, Short Circuit Analysis of Large Power Systems using Zbus, Analysis of Open Circuit faults.

UNIT-IV:
Security Analysis: Basic Concepts, Static Security Analysis at Control Centers, ContingencyAnalysis, Contingency Selection.

UNIT-V:
Stability Analysis: Classification of Power System Stability, Classical Model of SynchronousMachines and Excitation System, Transient Stability Analysis of Multi-Machine Systems, Eigen Analysis ofDynamical Systems, Small Signal Stability Analysis using Classical Model, Basic Concepts of VoltageStability Analysis.

Text Books:
1. D.P. Kothari & I.J. Nagrath, “Modern Power System Analysis”, Tata Mc Graw Hill, 3rd Edition
2. P.S.R. Murty, “Operation and Control in Power Systems”, B.S. Publications
3. O.I.Elgerd,Electric Energy Systems Theory - An Introduction, McGraw-Hill, 1988.
4. J.D. Glover, M.Sarma and T.J. Overbye,Power System Analysis and Design, Fourth Edition,Thomson Engineering Press, 2008.
5. J. Wood & B.F. Wollenburg, “Power Generation, Operation and Control”, John Wiley & Sons

High Voltage Engineering
(BTEE702D)

Pre-requisites of course: Power System-I and II

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO1	Describe conduction and breakdown phenomenon in gases, liquid dielectrics and solid dielectrics.	K1
CO2	Explain generation of high voltages and currents	K2
CO3	Explain measurement techniques for high voltages and currents	K2
CO4	Describe overvoltage phenomenon and insulation coordination in electric power systems.	K2
	Describe non-destructive testing of materials and electric apparatus andhigh-voltage testing of electric apparatus	K2

UNIT-I: Conduction and Breakdown in Gases:

Gases as Insulating Media, Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics:Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics:Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

UNIT-II: Generation of High Voltages and Currents:

Generation of high direct current voltages, generation of high alternating voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT –III: Measurement of High Voltages and Currents:

Measurement of high direct current voltages, measurement of high alternating and impulse voltages, measurement of high direct, alternating and impulse currents, Cathode Ray Oscillographs for impulse voltage and current measurements.

UNIT-IV: Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems

National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

UNIT-V: Non-Destructive Testing of Materials and Electrical Apparatus Measurement of dielectric constant and loss factor, partial discharge measurements
High Voltage Testing: Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, testing of transformers, testing of surge arresters, radio interference measurements.

Text Books:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering, Tata Mc-Graw Hill.
2. C. L. Wadhwa, "High Voltage Engineering", Wiley Eastern Ltd.

Reference Books:

1. E. Kuffel and W. S. Zacngal, High Voltage Engineering", Pergamon Press.
2. M. P. Chaurasia , "High Voltage Engineering", Khanna Publishers
3. R. S. Jha, "High Voltage Engineering", DhanpatRai& sons
4. M. Khalifa,' High Voltage Engineering Theory and Practice,' Marcel Dekker.
5. Subir Ray,' An Introduction to High Voltage Engineering' Prentice Hall of India

Energy Efficiency & Conservation
(BTEE703A)

Pre-requisites of course: Electrical Machine, Power System

Course Outcomes: After completion of the course student will be able to:

1. Study the concept of Energy conservation:
2. Analysis of Energy management Team Consideration in lamenting energy conservation Programme
3. Demonstration of Voltage and Reactive power in Distribution Systems
4. Explain the Efficiency in Motors and Lighting system

Unit-I:
Energy conservation: Principles of Energy Conservation, Energy conservation Planning, Energy conservation in small scale industries, Large scale industries and in electrical generation, transmission and distribution, Energy conservation Legislation.

Unit-II
Energy Audit: Aim of energy Audit, Strategic of Energy Audit, Energy management Team Consideration in implementing energy conservation Programme, Instruments for energy audit, Energy audit of Electrical Systems, HVAC, Buildings, Economic analysis.

Unit-III:
Demand Side Management: Concept and Scope of Demand Side Management, Evolution of Demand Side Management, DSM Strategy, Planning, Implementation and its application, Customer Acceptance & its implementation issues, National and International Experiences with DSM.

Unit-IV:
Voltage and Reactive power in Distribution Systems: Voltage and reactive power calculations and control, Voltage classes and nomenclature, voltage drop calculations, Voltage control, VAR requirements and power factor, Capacitors unit and bank rating, Protection of capacitors and switching, Controls for switched capacitors and fields testing.

Unit-V:
Efficiency in Motors and Lighting system:Load scheduling/shifting, Motor Drives-motor efficiency testing, energy efficient motors, and motor speed control. Lighting- lighting levels, efficient options, fixtures, day lighting, timers, Energy efficient windows, UPS selection, Installation operation and maintenance. Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003.

Text / Reference Books

1. Tripathy S.C., "Electric Energy Utilization and Conservation', Tata McGraw Hill.
2. Industrial Energy Conservation Manuals, MIT Press, Mass
3. "The Efficient Use of Energy", Edited by I.G.C.Dryden, Butterworths, London
4. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York
5. L.C.Witte, "P.S.Schmidt, D.R.Brown, Industrial Energy Management and Utilization", HemispherePubl, Washington
6. Power Capacitor Handbook, Butterworth & Co (Publishers) Ltd
7. Electrical Systems Analysis and Design for Industrial Plants, Mcgraw-Hill Book Company.

8. IEEE Bronze Book, “Recommended Practice for Energy Conservation and cost effective planning in industrial facilities”, IEEE Press

Reliability Engineering
(BTEE703B)

Pre-requisites of course: Electrical Machine, Power System

Course Outcomes: After completion of the course student will be able to:

1. Study the concept of reliability
2. Analyze the Smart Grid Technologies
3. Analyze smart substations
4. Demonstrate procedures and analysis of Power Quality Management in Smart Grid

Unit-I:
Introduction: Introduction to Smart Grid: Evolution of Electric Grid, Concept of Smart Grid, Definitions, Need of Smart Grid, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Difference between conventional & smart grid, Concept of Resilient & Self Healing Grid, Present development & International policies in Smart Grid. Case study of Smart Grid. CDM opportunities in Smart Grid.

Unit-II: Smart Grid Technologies: Introduction to Smart Meters, Real Time Prizing, Smart Appliances, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid, Smart Sensors, Home & Building Automation.

Unit-III: Smart Grid Technologies: Smart Substations, Substation Automation, Feeder Automation, Geographic Information System (GIS), Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro, Compressed Air Energy Storage, Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU), PMUs application to monitoring & control of power system.

Unit-IV: Microgrids and Distributed Energy Resources: Concept of microgrid, need & application of microgrid, formation of microgrid, Issues of interconnection, protection & control of microgrid, Plastic & Organic solar cells, thin flim solar cells, Variable speed wind generators, fuel cells, microturbines, Captive power plants, Integration of renewable energy sources.

Unit V: Power Quality Management in Smart Grid: Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring.

Text Books:
1. Ali Keyhani, Mohammad N. Marwali, Min Dai, "Integration of Green and Renewable Energy in Electric Power Systems", Wiley.
2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press.
3. Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley.
4. Jean Claude Sabonnadiere, NouredineHadjsaid, "Smart Grids", Wiley Blackwell 19.
5. Stuart Borlase, "Smart Grids (Power Engineering)", CRC Press.
Reference Books:
6. Andres Carvallo, John Cooper, "The Advanced Smart Grid: Edge Power Driving Sustainability", Artech House Publishers July 2011.
7. James Northcote, Green, Robert G. Wilson "Control and Automation of Electric Power Distribution Systems (Power Engineering)", CRC Press.

8. MladenKezunovic, Mark G. Adamiak, Alexander P. Apostolov, Jeffrey George Gilbert “Substation Automation (Power Electronice and Power Systems)”, Springer
9. R.C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, “Electrical Power System Quality”, 2nd Edition, McGraw Hill Publication.

EHV AC & DC TRANSMISSION
(BTEE703C)

Pre-requisites of course: Power System

Course Outcomes: After completion of the course student will be able to:

1. Need of EHV transmission,
2. Describe the characteristics and generation of impulse voltage
3. Explain the converter controls characteristics
4. Analysis of protection against over currents and over voltages

UNIT-I:
Need of EHV transmission, standard transmission voltage, comparison of EHV AC & DC transmission systems and their applications & limitations, surface voltage gradients in conductor, distribution of voltage gradients on sub-conductors, mechanical considerations of transmission lines, modern trends in EHV AC and DC transmission.

UNIT-II: EHV AC Transmission:
Corona loss formulas, corona current, audible noise – generation and characteristics corona pulses their generation and properties, radio interference (RI) effects, over voltage due to switching, ferroresonance, reduction of switching surges on EHV system, principle of half wave transmission.

UNIT-III: Extra High Voltage Testing:
Characteristics and generation of impulse voltage, generation of high AC and DC voltages, measurement of high voltage by sphere gaps and potential dividers. Consideration for Design of EHV Lines: Design factors under steady state limits, EHV line insulation design based upon transient over voltages. Effects of pollution on performance of EHV lines.

UNIT-IV: EHV DC Transmission – I:
Types of dc links, converter station, choice of converter configuration and pulse number, effect of source inductance on operation of converters. Principle of DC link control, converter controls characteristics, firing angle control, current and excitation angle control, power control, starting and stopping of DC link.

UNIT-V:EHV DC Transmission – II:
Converter faults, protection against over currents and over voltages, smoothing reactors, generation of harmonics, AC and DC filters, Multi Terminal DC systems (MTDC): Types, control, protection and applications.

Text Books:
1.R. D. Begamudre, “Extra High Voltage AC Transmission Engineering” Wiley Eastern.
2.K. R. Padiyar, “HVDC Power Transmission Systems: Technology and System Reactions” New Age International.
3.J. Arrillaga,“ High Voltage Direct current Transmission” IFFE Power Engineering Series 6, Peter Peregrinus Ltd, London.
4.M. S. Naidu & V. Kamaraju, “High Voltage Engineering” Tata Mc Graw Hill. Reference Books:
5.M. H. Rashid , “ Power Electronics : Circuits, Devices and Applications” Prentice Hall of India.
6.S. Rao, “EHV AC and HVDC Transmission Engineering and Practice” Khanna Publisher.

7. “EPRI, Transmission Line Reference Book, 345 KV and above” Electric Power Research Institute. Palo Alto, California, 1982

Power Quality and Facts
(BTEE703D)

Pre-requisites of the course: Power System-I & II

Course Outcome		Knowledge Level
Upon the completion of the course, the student will be able to:		
CO1	Classify the power quality issues in electrical distribution network	K2
CO2	Describe the sources of voltage sag and protective devices including voltage regulators, active series compensator and UPS.	K1
CO3	Describe the different phenomenon causing electrical transients and devices for over voltage protection.	K2
CO4	Explain the working and application of different type of FACT devices like SSC, SVC, TSC, SSS, TCSC, UPFC.	K2
CO5	Explain the causes of harmonics, its effect on motor ,capacitor, cables and mitigation techniques.	K2

Unit-I: Introduction to Power Quality:

Terms and definitions of transients, Long duration Voltage Variations: under Voltage, Under Voltage and Sustained Interruptions; Short Duration Voltage Variations: interruption, Sag, Swell; Voltage Imbalance; Notching D C offset, waveform distortion; voltage fluctuation; power frequency variations.

Unit-II: Voltage Sag:

Sources of voltage sag: motor starting, arc furnace, fault clearing etc; estimating voltage sag performance and principle of its protection; solutions at end user level- Isolation Transformer, Voltage Regulator, Static UPS, Rotary UPS, and Active Series Compensator.

Unit-III: Electrical Transients:

Sources of Transient Over voltages- Atmospheric and switching transients- motor starting transients, pf correction capacitor switching transients, ups switching transients, neutral voltage swing etc; devices for over voltage protection.

Unit-IV: FACT Systems:

Introduction – Terms & Definition, Fact Controllers, Type of FACT devices i.e. SSC, SVC, TSC, SSSC, TCSC, UPFC Basic relationship for power flow control.

Unit- V: Harmonics:

Causes of harmonics; current and voltage harmonics: measurement of harmonics; effects of harmonics on – Transformers, AC Motors, Capacitor Banks, Cables, and Communication Lines etc., Harmonic Mitigation Techniques.

Text Books:

1. Roger C Dugan, McGrahan, Santoso&Beaty, "Electrical Power System Quality" McGraw Hill
2. Arindam Ghosh & Gerard Ledwich, "Power Quality Enhancement Using Custom Power Devices" Kluwer Academic Publishers
3. C. Sankaran, "Power Quality" CRC Press.
4. S. Sivanagaraju& S. Satyanarayana, "Electric Power Transmission and Distribution" Pearson Education
5. Narain G. Hingorani& Laszlo Gyugyi "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems" Wiley

Digital and Social Media Marketing
(BTEEOE704A)

COURSE OBJECTIVE

- Introduce current and core practices of Digital and Social Media Marketing that will allow learners to analyses, plan, execute and evaluate a digital marketing strategy.
- Introduce core tools currently used in Digital and Social Media Marketing that will allow learners to analyses, plan, execute and evaluate a digital marketing strategy.
- Develop an understanding of Search Engine Optimization (SEO), Social Media Optimization, Affiliate and other relevant communication channels for engagement of digital communities.

COURSE OUTCOMES

Through successful completion of this course, students will:

- Understand what social media is, the various channels through which it operates, and its role in marketing strategy.
- Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers.
- Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks.
- Measure the impact of a social media campaign in terms of a specific marketing objective

UNIT-I

Introduction to Digital Marketing: The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. Marketing strategies for the digital world-latest practices. **[8]**

UNIT-II

Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns **[8]**

UNIT-III

Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing. Marketing gamification, Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO). **[8]**

UNIT-IV

Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies **[8]**

UNIT-V

Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation. **[8]**

Text books:

1. Moutsy Maiti: Internet Mareting, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).
4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).
5. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

Idea to Business Model
(BTEEOE704B)

Course Objectives:

- This course can motivate students to have an overall idea how to start and sustain a business enterprise.
- The students will learn basics of choosing an idea of a business model.
- The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.

Course Outcome:

- Examine the challenges associated with defining the concepts of entrepreneur and entrepreneurship
- Discuss how the evolution of entrepreneurship thought has influenced how we view the concept of entrepreneurship today
- Discuss how the list of basic questions in entrepreneurship research can be expanded to include research inquiries that are important in today's world
- Discuss how the concepts of entrepreneurial uniqueness, entrepreneurial personality traits, and entrepreneurial cognitions can help society improve its support for entrepreneurship
- Apply the general venturing script to the study of entrepreneurship

Unit-I Introduction

Search for a business idea- How to choose an idea- Product idea- selection of product- The adoption process- Product innovation- Production , planning and development strategy- New product idea. **[8]**

Unit-II Introduction to Entrepreneurship - Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur.- Entrepreneur vs Managerrole of entrepreneurship in economic development – Barriers to entrepreneurship. **[8]**

Unit-III The Entrepreneur - types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development prog (EDP)- Evaluation of EDP - Entrepreneur development training. **[8]**

Unit-IV Production system- Design of production system- Types of production system- Production, planning & control (PPC) - Steps of PPC. **[8]**

Unit-V Communication- Importance of communication system - barriers to communication - listening to people- the power of talk - personal selling - risk taking & resilience - negotiation. **[8]**

Text Books:

1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition
2. Production & operations Management- Kanishka Bedi,
3. Marketing Management- Philip Kotler.

4. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock , Gerard George

Machine Learning
(BTEEOE704C)

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques.
5. Design application using machine learning techniques.

UNIT-I

INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning;

THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias. **[8]**

UNIT-II

DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning;

ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of back propagation rule Back propagation Algorithm Convergence, Generalization. **[8]**

UNIT-III

Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naive Bayes classifier, Bayesian belief networks, EM algorithm. **[8]**

UNIT-IV

Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-**BASED LEARNING** – k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks, Case based learning. **[8]**

UNIT-V

Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules sequential covering algorithms-General to specific beam search-FOIL;

REINFORCEMENT LEARNING - The Learning Task, Q Learning. **[8]**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer- Verlag.

Renewable Energy Resources
(BTEEOE704D)

Course Objectives:

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. Analyse the environmental aspects of renewable energy resources.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
2. Know the need of renewable energy resources, historical and latest developments.
3. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
6. Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.
7. Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

UNIT-I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells: Theory of solar cells. Solar cell materials , solar cellarray, solarcell power plant, limitations. **[8]**

UNIT-II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal powerplants, thermal energy storage for solar heating and cooling, limitations. **[8]**

UNIT-III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-

hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

[8]

UNIT-IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. **[8]**

UNIT-V

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance a nd limitations.

Wave and Tidal Wave : Principle of working, performance and limitations. Waste Recycling Plants. **[8]**

Text books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle," Renewable Energy Power For A Sustainable Future", Oxford University Press.

Operations Research

(BTEEOE704E)

Course Objectives:
The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Identify and develop operational research models from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.
4. Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

UNIT-I
Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **[8]**

UNIT-II
Transportation Problems: Types of transportation problems, mathematical models , transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines. **[8]**

UNIT-III
Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **[8]**

UNIT-IV
Theory of Games : Rectangular games, Minimax theorem, graphical solution of 2x nor mx2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models. **[8]**

UNIT-V
Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time. **[8]**

Text books:

1. Wayne L. Winston,"Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

Value Relationship & Ethical Human Conduct –For A Happy & Harmonious Society
(BTEEOE704F)

Course Objectives:

1. To help the students to understand the importance and types of relationship with expressions.
2. To develop the competence to think about the conceptual framework of undivided society as well as universal human order.
3. To help the students to develop the exposure for transition from current state to the undivided society and universal human order.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-a-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs. Introduction to the course: Basic aspiration of a Human Being and program for its fulfilment, Need for family and relationship for a Human Being, Humanhuman relationship and role of behavior in its fulfillment, Human-rest of Nature

UNIT-I

Relationship and role of work in its fulfilment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order, an appraisal of the Current State, Appraisal of Efforts in this Direction in Human History.

UNIT-II

Understanding Human-Human Relationship & its fulfilment: Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfilment, Expression of feelings, Types of relationship and their purpose, mutual evaluation in relationship, Meaning of justice in relationship, Justice leading to culture, civilization and Human Conduct.

UNIT-III

Justice from family to world family order: Undivided Society as continuity and expanse of Justice in behaviour – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order, Universal Human Order as continuity and expanse of order in living: from family order to world family order, a conceptual framework for universal human order.

UNIT-IV

Program for Ensuring Undivided Society and Universal Human Order: Education –Sanskar, Health – Sanyam, Production-work, Exchange – storage, Justice-preservation.

UNIT-V

Human Tradition: Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

Text books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual),
2. R. R. Gaur, R. Asthana, G. P. Bagaria (2010), Excel Books, New Delhi.
3. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
4. An Appeal by the Dalai Lama to the World: Ethics Are More Important Than Religion, Dalai Lama XIV, 2015.
5. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India.
6. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA.
7. Human Society, Kingsley Davis, 1949.
8. Hind Swaraj or, Indian home rule Mohandas K. Gandhi, 1909.
9. Integral Humanism, Deendayal Upadhyaya, 1965.
10. Lohiya Ke Vichar, Lok Bharti , Rammanohar Lohiya, 2008.
11. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
12. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
13. Samadhanatmak Bhautikvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India
14. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher,1973, Blond & Briggs, UK.
15. Slow is Beautiful, Cecile Andrews (http://www.newsociety.com/Books/S/Slow-is- Beautiful)
16. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.
17. Samagra kranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
18. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi
19. Vyavaharvadi Samajshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
20. Vyavahatmak Janvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
21. The Communist Manifesto, Karl Marx, 1848.
22. Toward a True Kinship of Faiths: How the World's Religions Can Come Together Dalai Lama XIV, 2011

Reference Videos.

1. Kin school (30 minutes)
2. Technology (Solar City etc.).
3. Natural Farming.
4. Economics of Happiness (1h 8m).

Mini Project

(BTEE706P)

Students will be asked to work upon minimum one topic during the semester.

They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.

Internship Assessment

(BTEE707P)

Project Management & Entrepreneurship

(BTEE801)

Unit	Topics	Lectures
I	**Entrepreneurship:** Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes	8
II	**Entrepreneurial Idea and Innovation:** Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness	8
III	**Project Management:** Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.	8
IV	**Project Financing:** Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.	8
V	**Social Entrepreneurship:** Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.	8

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Power System Protection
(BTEE802)

Pre-requisites of the course: Power System-I, Power System-II

Course Outcome		Knowledge Level
Upon the completion of the course, the student will be able to:		
CO1	Describe the relays and different protective schemes.	**K1**
CO2	Explain Relay types and its application.	**K2**
CO3	Describe types of faults and protection scheme for major components of power system.	**K2**
CO4	Describe the circuit breaker operation, testing and types.	**K2**
CO5	Explain the electronic relay, microprocessor and computer based protection schemes.	**K2**

Unit-I: Protection Scheme

Need for Protective systems, Evolution of protective relays - Zones of protection - Primary and Back - up Protection - Essential qualities of Protection - Classification of Protective schemes -Automatic reclosing – current transformer for Protection - potential transformer - summation transformer -phase – sequence current - segregating network

Unit-II: Relays:

Electromagnetic, attracted and induction type relays, thermal relay, gas actuated relay, design considerations of electromagnetic relay. Relay Application and Characteristics: Amplitude and phase comparators, over current relays, directional relays, distance relays, differential relay Static Relays: Comparison with electromagnetic relay, classification and their description, over current relays, directional relay, distance relays, differential relay.

Unit-III: Protection of Components

Types & detection of faults and their effects, alternator protection scheme (stator, rotor, reverse power protection etc.) - Power transformer protection (external and internal faults protection), generator-transformer unit protection scheme, bus bar protection - Transmission line protection (current/time grading, distance), Pilot relaying schemes, power line carrier protection.

Unit-IV: Circuit Breaking

Properties of arc, arc extinction theories, re-striking voltage transient, current chopping, resistance switching, capacitive current interruption, short line interruption, circuit breaker ratings. Testing of Circuit Breaker: Classification, testing station and equipment, testing procedure, direct and indirect testing, selection of circuit breakers. constructional features and operation of Bulk Oil, Minimum Oil, Air Blast, SF6, Vacuum and d. c. circuit breakers.

UNIT V- Modern Trends in Protection

Electronic relays - static relays functional circuits: comparators, level detectors, logic and training circuits, microprocessor and computer based protection schemes - software development for protection, security and reliability.

Text Books:

1. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
2. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.
3. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Mc Graw Hill

Subject Code: BTEEOE803A	FILTER DESIGN	3L:0T:0P	3 Credits

COURSE OBJECTIVE: Students undergoing this course are expected to:

1. Understand about the characteristics of different filters.
2. Understand the concept of Approximation Theory.
3. Learn about the switched capacitor filter.

COURSE OUTCOME: After completion of the course student will be able to:

CO1	Choose an appropriate transform for the given signal.
CO2	Choose appropriate decimation and interpolation factors for high performance filters.
CO3	Model and design an AR system.
CO4	Implement filter algorithms on a given DSP processor platform.

Unit	Topics	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulationand modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	8
II	First order filter: Bilinear transfer functions and frequency response – Bilinear transfer function and its parts, realization of passive elements, Bode plots, Active realization, The effect of A(s), cascade design.	8
III	Second order low pass and band pass filters: Design parameters, Second order circuit, frequency response of low pass and band pass circuits, Integrators and others biquads.	8
IV	Second order filters with arbitrary transmission zeros: By using summing, By voltage feed forward, cascade design revisited. Low pass filters with maximally flat magnitude: the ideal low pass filter, Butterworth response, Butterworth pole locations, low pass filter specifications, arbitrary transmission zeros.	8
V	Low pass filter with equal ripple (Chebyshev) magnitude response: The chebyshev polynomial ,The chebyshev magnitude response, Location of chebyshev poles, Comparison of maximally flat & equal–ripple responses, Chebyshev filter design Inverse chebyshev and cauer filters: Inverse chebyshev response, From specifications to pole and zero locations, Cauer magnitude response, Chebyshev rational functions, Cauer filter design.	8

Text Book:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, "Analog Filter Design", 2ndIndianEdition, Oxford University Press.

Reference Books:

1. J. Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Second edition,Pearson.

2. T. Deliyannis, Yichuang Sun, J.K. Fidler, “Continuous-Time Active Filter Design”,CRC Press.

Subject Code: BTEEOE803B	BIOECONOMICS	3L:0T:0P	3 Credits

OBJECTIVE:

This course is designed with an objective to provide an understanding of the basic knowledge of bioecomics to students so that they can explore entrepreneurship opportunities in the bio based industry. This course also serves interdisciplinary innovation in terms of sustainable bioeconomy

COURSE OUTCOME: After completion of the course student will be able to:

1. Students will be able to understand basic concept of Bioeconomics, challenges, opportunities& regulations
2. Students will be able to understand development and innovation in terms of bioeconomy towards sustainable development
3. Students will be able to understand Inter- and transdisciplinarity in bioeconomy &research approaches
4. Students will be able to explain biobased resources ,value chain, innovative use of biomass and biological knowledge to provide food, feed, industrial products

Unit	Topics	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulationand modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	08
II	Economic Growth, Development, and Innovation in terms of bioeconomy, Environmental Economics and the Role of Government, Modelling and Tools Supporting the Transition to a Bioeconomy, Role of biobased Economy in sustainable development.	08
III	Inter- and transdisciplinarity in Bioeconomy & research approaches, primary production, processing of bio based resources, Markets, Sustainability Management and Entrepreneurship in biobased products.	08
IV	Biobased Resources and Value Chains, Processing of Biobased Resources, Markets, Sustainability Management and Entrepreneurship opportunity in biobased product. Food Security and Healthy Nutrition in the Context of the Bioeconomy, Use of Biomass for the Production of Fuel and Chemicals, The importance of Biotechnology for the Bioeconomy.	08
V	sustainable and innovative use of biomass and biological knowledge to provide food, feed, industrial products, bioenergy and ecological services, importance of bioeconomy- related concepts in public, scientific, and political discourse, Dynamic Management of Fossil Fuel, Biofuel.	08

Text Book:

1. Principles of Bioeconomics by I. Sundar, Vedams eBooks (P) Ltd New Delhi, India
2. Bioeconomy:Shaping the Transition to a Sustainable, Biobased Economy by Iris Lewandowski, Springer.
3. Sociobiology and Bioeconomics by Koslowski, Peter
4. Modeling, Dynamics, Optimization and Bioeconomics I, by Pinto, Alberto Adrego, Zilberman, David, Springer.

Subject Code: BTEEOE803C	Design Thinking	3L:0T:0P	3Credits

Objective:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real- time problems

Unit	*Topics*	Lectures
I	Introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world	8
II	Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family society, institution, startup, socialization process. Ethical behavior: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, customer journey maps, and brainstorming, Classifying insights after Observations, Classifying Stakeholders, Do's & Don'ts for Brainstorming, Individual activity- 'Moccasin walk'	8
III	Defining the problem statement, creating personas, Point of View (POV) statements. Research- identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation-basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, JamBoard	8
IV	Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills-linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.	8

V	The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments.	8

Text Book:

1. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
2. BP Banerjee, Foundations of Ethics and Management, 2005, Excel Books
3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA

Course Outcome: After successful completion of the course the students will be able to:

1. Develop a strong understanding of the design process and apply it in a variety of business settings
2. Analyze self, culture, teamwork to work in a multidisciplinary environment and exhibit empathetic behavior
3. Formulate specific problem statements of real time issues and generate innovative ideas using design tools
4. Apply critical thinking skills in order to arrive at the root cause from a set of likely causes
5. Demonstrate an enhanced ability to apply design thinking skills for evaluation of claims and arguments.

Subject Code: BTEEOE803D	Introduction to Women's and Gender Studies	3L:0T:0P	3Credits

Unit	*Topic*	Lectures
I	**Women and Society:** Understanding Sex- Gender, Gender shaping Institutions, Theories of Gender construction Understanding Sexism and Androcentrism, Understanding Patriarchy and Theories of Patriarchy, Private and Public dichotomy, Sexual Division of Work, Patriarchy practices in different institutions and Text Books.	8
II	**Feminist Theory:** Rise of Feminism, Introduction to various stands of Feminism- Liberal Feminism, Radical Feminism, Marxist Feminism, Socialist Feminism, Cultural Feminism, Eco-Feminism, Post Colonial Feminism, Post Modern Feminism. Waves of Feminism.	8
III	**Women's Movement:** The socio-economic conditions of women during the age of Industrial revolution the Call for Women's Rights 1848, Women's rights movement 1848-1920,Historical Developments of Social Reform Movements in India , Women's groups and organizations, Women's Movement Movements for Uniform Civil code and ShahBano case, Dalit women and the question of double marginality.	8
IV	**Gender Roles and Psychology of Sex:** Difference Conceptualization of gender roles and gender role attitudes, Gender: Aggression, Achievement, Communication, Friendship and Romantic, Relationships Sex Differences in Mental Health Trauma relating to Rape , Taboo , Childhood Sexual Abuse , Domestic Violence , Sexual Harassment at Work Place, Educational Institutions, Eve Teasing etc.	8
V	**Gender and Representation:** Gender and Mass Media- Print Media, Gender and Mass Media-Electronic Media, Gender and Films, Advertisements, Mega Serials, Stereotyping and breaking the norms of women's roles Women's Representation in Literary Texts.	8

Suggested reading:

1. Basab iChakrabarti, Women's Studies: Various Aspects. UrbiPrakashani2014
2. Arvind Narrain. Queer: Despised Sexuality Law and Social Change. Book for Change. 2005
3. Chandra Talpade Mohanty, Feminism without Borders: Decolonizing Theory, Practicing Solidarity. Duke University Press.
4. Flavia Agnes. Law and Gender Inequality: The Politics of Women's Rights in India.

   Oxford University Press, 2001

5. Sonia Bathla, Women, Democracy and the Media: Cultural and Political Representations in the Indian Press, Sage, New Delhi, 1998.

Subject Code: BTEEOE803E	Quality Management	3L:0T:0P	3Credits

COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Introduce the importance of quality in improving competitiveness.
2. Understand the Implication of Quality on Business.
3. Implement Quality Implementation Programs.
4. Have exposure to challenges in Quality Improvement Programs.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Realize the importance of significance of quality.

CO2: Manage quality improvement teams.

CO3: Identify requirements of quality improvement programs.

CO4: Identify improvement areas based on cost of poor quality.

CO5: Organize for quality and development of quality culture through small group activities.

Unit	Topic	Lectures
1	Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims.	8
2	Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.	8
3	Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts.	8
4	Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle.	8
5	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	8

Text and Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.

Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Subject Code: BTEEOE803F	Modeling of Field-Effect Nano Devices	3L:0T:0P	3Credits

COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
2. Introduce the concepts of nanoscale MOS transistor and their performance characteristics.
3. Study the various nano-scaled MOS transistor circuits.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Study the MOS devices used below 10nm and beyond with an eye on the future.

CO2: Understand and study the physics behind the operation of multi-gate systems.

CO3: Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristics.

CO4: Understand and study the physics behind the Radiation effects in SOI MOSFETs.

CO5: Understand the impact of device performance on digital circuits.

Unit	Topic	Lectures
1	MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility – threshold voltage – inter subband scattering, multigate technology – mobility – gate stack	**8**
2	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics – CMOS Technology – Ultimate limits, double gate MOS system – gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering – mobility	**8**

3	Silicon nanowire MOSFETs – Evaluvation of I-V characteristics – The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube – Band structure of carbon nanotube – Band structure of graphene – Physical structure of nanotube – Band structure of nanotube – Carbon nanotube FETs – Carbon nanotube MOSFETs – Schottky barrier carbon nanotube FETs – Electronic conduction in molecules – General model for ballistic nano transistors – MOSFETs with 0D, 1D, and 2D channels – Molecular transistors – Single electron charging – Single electron transistors.	**8**
4	Radiation effects in SOI MOSFETs, total ionizing dose effects – single-gate SOI – multi-gate devices, single event effect, scaling effects	**8**
5	Digital circuits – impact of device performance on digital circuits – leakage performance trade off – multi VT devices and circuits – SRAM design, analog circuit design – transconductance - intrinsic gain – flicker noise – self heating –band gap voltage reference – operational amplifier – comparator designs, mixed signal – successive approximation DAC, RF circuits.	**8**

Text and Reference Books:

1. J P Colinge, "FINFETs and other multi-gate transistors", Springer – Series on integrated circuits and systems, 2008
2. Mark Lundstrom, Jing Guo, "Nanoscale Transistors: Device Physics, Modeling and Simulation", Springer, 2006
3. M S Lundstorm, "Fundamentals of Carrier Transport", 2nd Ed., Cambridge University Press, Cambridge UK, 2000.

Subject Code: BTEEOE803G	Computerized Process Control	3L:0T:0P	3Credits

COURSE OBJECTIVE: Students undergoing this course are expected to-

1. Understand Basics of Computer-Aided Process Control.
2. Analyse Industrial communication System.
3. Design Process Modelling for computerized Process control.
4. Design Advanced Strategies For Computerised Process control.
5. Analyse Computerized Process Control.

COURSE OUTCOME: After completion of the course student will be able to-

CO1: Understand the Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer.

CO2: Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System – TDM/PAM system.

CO3: Realize Process model, Physical model, Control Model. Modelling Procedure.

CO4: Formulate of Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.

CO5: Design Electric Oven Temperature Control, Reheat Furnace Temperature control.

Unit	Topic	Lectures
1	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer –Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces.	8
2	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System	8
3	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation	8

4	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	**8**
5	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	**8**

Text Books:

1. S. K. Singh, "Computer Aided Process control", PHI.

Reference Books:

1. C. L. Smith, "Digital computer Process Control", Ident Educational Publishers.
2. C. D. Johnson, "Process Control Instrumentation Technology", PHI.
3. Krishan Kant, "Computer Based Industrial Control"
4. Pradeep B. Deshpande & Raymond H. Ash, "Element of Computer Process Control with Advance Control Applications", Instrument Society of America, 1981.
5. C. M. Houpis & G. B. Lamond, "Digital Control System Theory", Tata McGraw Hill.

Power System Protection-Lab
Subject Code: BTEE804P

List of experiments: (To be performed minimum 10 experiments)

1. To study Over current Relay static type & draw characteristics.
2. To study under voltage relay Electromechanical type & draw characteristics.
3. To study over voltage relay Electromechanical type & draw characteristics.
4. To study IDMT Over current relay Electromechanical Type & draw current verses time characteristics.
5. To study IDMT earth fault relay electromechanical type draw current verses time characteristics.
6. To study operating characteristics of percentage-biased differential relays tp plot the characteristics of percentage biased differential relay for 30%, 40%, & 20%.
7. To determine the characteristics of instantaneous relays.
8. To study Bucholz Relays.
9. To study Solid State O.C.R.
10. To study Merz Price Protection of transformer (Simulation Model).
11. To study Static type negative sequence relay.
12. To study the time-grading protection of feeder [simulation Model].
13. To study the current-grading protection of feeder [simulation Model].
14. To study the time-current grading protection of feeder [simulation Model].
15. To study the simulation model for short, medium, & long transmission line.

Apparatus Required:

Relays
Transformer
Alarm
Auxiliary power supply
Variable voltage source
Digital meter, digital time totalizer

Reference Book:

1. Protection –Westing House.

Project
Subject Code: BTEE805P