Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute under Mumbai University)
Andheri (W), Mumbai – 400058

COURSE CONTENTS

Sem. III

S. Y. B.Tech. (ELECTRICAL) ENGINEERING

Academic Year: 2023-2024

List of Courses

BS-BTE301 Laplace Transform, Vector calculus & Linear Algebra

PC-BTE301 Electronic Circuits

PC-BTE302 Electrical Networks

PC-BTE303 Digital Electronics

PC-BTE304 Electromagnetic Fields & Waves

PC-BTE 351 Electronic Circuits Laboratory

PC-BTE352 Electrical Network Laboratory

PC-BTE353 Digital Electronics Laboratory

PC-BTE354 Electromagnetic Fields & Waves Laboratory

HS-BTE301 Organizational Communication and Interpersonal Skills

VA-BTExxx Value Added courses (Refer Appendix I)

Course Code	Course Name
BS-BTE301	**Laplace Transform, Vector calculus & Linear Algebra**
Course pre-requisites	DCCN(BS-BT101) , ICDE(BS-BT201)

Course Objectives

The objectives of this course are

1. To learn Laplace & Inverse Laplace transforms and its application to solve differential equations.
2. To understand concept of Vector calculus.
3. To learn various matrices, operations and important theorems.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Solve problems based on Laplace and inverse Laplace transform. Apply theory of Laplace transforms to evaluate real integrals and solve initial &boundary value problems.
2. Solve problem based on vector differentiation & vector Integration.
3. Find rank of matrices, Eigen values and Eigen vectors of matrices

Course Content

Module No.	*Details*	*Hrs.*
1	**Laplace Transforms** Function of bounded variation (Statement only) Laplace Transforms of $1, e^{at}, \sin at, \cos at, \sinh at, \cosh at, t^n, erf\left(\sqrt{t}\right), J_0(t)$,Shifting theorems, change of scale, $L\{t^n f(t)\}$, $L\left\{\frac{f(t)}{t}\right\}$, $L\left\{\frac{d^n f(t)}{dt^n}\right\}$, $L\left\{\int_0^t f(u)du\right\}$ Convolution theorem, Evaluation of real integrals using Laplace transforms.	07
2	**Inverse Laplace Transforms** Evaluation of Inverse Laplace Transforms using partial fractions, convolution theorem, shifting theorems and other properties. Application of Laplace Transform to solve initial & boundary value problems involving ordinary differential equation with one dependent variables.	08
3	**Vector Differentiation:** Introduction of Scalar point function & vector point function, Gradient, Geometrical meaning of Grad, Directional Derivative, Divergence Curl of VPF, Properties of grad divergence & Curl.	05
4	**Vector Integration -I:** Vector integrals – Line and Surface Integrals, Green theorem in plane. Problems based on work done. Conservative force field.	05

5	**Vector Integration -II:** Stoke's theorem, Gauss's Divergence theorem. Applications of Vector Integrals to Electrical engineering	05
6	**Matrices** Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian & Unitary matrices and their elementary properties. Elementary operations and their use in getting the Rank, Normalform of a matrix, PAQ form, Consistency of system of linear homogeneous and non-homogeneous equations.	06
7	**Eigen values and Cayley Hamilton Theorem** Eigen-values and Eigenvectors of a matrix, Cayley- Hamilton theorem, Function of a matrix, Diagonalization of a matrix	06

Term Work

Term work shall comprise of

A total of 10 tutorials to be taken batch wise covering the entire syllabus..

Text Books

1. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43rdEdition, ISBN 8174091955, 1315 Pages

Reference Books

1. Erwin Kreyszig (2010), "Advanced Engineering Mathematics" WileyEastern Limited, Singapore 10th edition, ISBN 8126554231, 1148 Pages.
2. Text book of Engineering Mathematics , N.P.Bali , Laxmi Publications, 9th edition,ISBN:978-81- 318-0832-0
3. Murray Spiegel. "Vector Analysis" Schaum's Outline Series.

Sr. No.	Examination	Module
1	T-I	1 , 2 and part of 3
2	T-II	Remaining part of 3, 4 andpart of module 5
3	End Sem	1 to 7

Course Code	Course Name
PC-BTE301	**Electronic Circuits**

Course pre-requisites	P-N junction diode, BJT, FET characteristics (Course Basic Electrical and Electronics)

Course Objectives
The objectives of this course are 1. Discuss various transistors and its biasing techniques. 2. Discuss Op-amp and its practical applications and basics of analog and digital converter circuits. 3. Introduction and application of 555 timer and voltage regulator. 4. Discuss negative feedback amplifiers and oscillators
Course Outcomes
Upon successful completion of the course, students should be able to 1. Understand various biasing techniques for BJT and FET. 2. Select appropriate electronic components to design various op-amp circuits depending on application required. 3. Illustrate the functions of basic building blocks of 555 timer and its applications. 4. Compare circuits using negative feedback. 5. Select appropriate electronic devices to design oscillators

Course Content

Module No.	***Details***	***Hrs.***
1	**Bipolar Junction Transistor:** Different biasing techniques, Introduction to h- parameter equivalent circuit, Introduction to Stability Factors.	06
2	**Field Effect Transistor:** Different biasing techniques, Introduction to ac equivalent circuit. Introduction to MOSFET	06
3	**Differential Amplifier Circuit Configuration**: Introduction to DIBO, DISO, SIBO, SISO. Differential amplifier with swamping resistors, constant current bias and current mirror.	05
4	**Operational amplifier (Op-amp) :** Block diagram representation of typical Op-amp, equivalent circuit. Op-amp applications: Summing, scaling and averaging amplifiers, instrumentation amplifier, V to I converter (with floating load and grounded load), I to V converter, Differentiator, integrator, Precision	08

	rectifier, half wave and full wave, comparator, zero crossing detector, Schmitt trigger, clipper, clamper, Peak Detector.	
5	**555 timer:** Introduction to the block diagram, Applications: a stable and mono Stable multi vibrator with applications of each.	04
6	**Feedback amplifiers (Negative Feedback):** Introduction to negative and positive feedback, Negative feedback Current, Voltage: Series and Shunt type Effect of Negative feedback on: Input impedance, output impedance Voltage gain, current gain and bandwidth	08
7	**Oscillators:** Frequency of oscillation, Condition for maintenance of oscillations of: (i) RC phase shift (ii) Wien Bridge, Crystal oscillator.	05

For Self-Study : ADC and DAC circuits using Op-amp

Text Books
1. Robert Boylestad and Louis Nashelsky, "Electronic devices and circuits theory", 11th edition Pearson 2017 2. Donald A. Neamen, "Electronic Circuits Analysis and Design",. (SIE) 3rd edition 2006 3. Gayakwad Ramakant,"Op-Amps and Linear Integrated Circuits", Pearson 2015 4. D. Roy Choudhari and Shail B. Jain," Linear Integrated Circuits", New age International Publishers, 4th edition, 2018

Reference Books
1. Bhargava, Kulshreshtha, Gupta: "Basic Electronics and Linear Circuits" NITTTR Chandigarh, 2nd edition, 2013. 2. David Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008 3. Allen Mottershead,"Electronic Devices and Circuits an introduction", Prentice Hall of India, 1979 4. K. R. Botkar, "Integrated Circuits", Khanna Publication, 10th edition, 1987

Sr. No.	Examination	Module
1	T-I	1,2,3
2	T-II	4,5
3	End Semester Exam	01-07

Course Code	Course Name

PC-BTE302	**Electrical Networks**

Course pre-requisites	Basic Electrical Engineering

Course Objectives
The objectives of this course are to 1. Analyze basic electrical circuits using various network theorems. 2. Introduce the concept of graph theory and network topology. 3. Analyze transient and steady state performance of RLC circuits in time domain and frequency domain. 4. Understand basic philosophy of network synthesis.
Course Outcomes
Upon successful completion of the course, students should be able to 1. Apply network theorems for the analysis of electrical circuits. 2. Obtain transient and steady-state response of electrical circuits using time domain and frequency domain methods. 3. Determine network function of a given electrical network 4. Construct an electrical network for a given driving point network function.

Course Content

Module No.	***Details***	***Hrs.***
1	**DC Network Analysis:** KVL, KCL, Networks with Dependent Sources, Mesh and Super-mesh analysis, Nodal and Super node analysis, Superposition theorem, Source transformation, Thevenin's theorem , Norton's theorem.	04
2	**AC Network Analysis**: KVL, KCL, Mesh and Nodal Analysis, Superposition theorem, Source transformation, Thevenin's theorem , Norton's theorem, Maximum Power transfer theorem, series and parallel resonance.	05
3	**Graph Theory and Network Topology**: Concept of Graph of a Network, Tree, co-tree, Incidence, cutest and tie-set matrices, their relation to the Kirchoff's Laws and concept of Duality.	04
4	**RL, RC Circuit Analysis –** General and Particular solutions of first order differential equations, Properties of exponential response, Time constant, integrating factor, Initial Conditions in Network elements. Series and parallel RLC Circuit Analysis– Solution of Second order differential equations, Over-damped, critically damped and under-damped RLC circuit, Lossless LC circuits. Analysis of RLC Networks excited by external Energy Sources like step, ramp, impulse and sinusoidal source.	10
	Electrical Circuit Analysis Using Laplace Transform: Review of Laplace Transform, Laplace Transform for standard inputs, inverse Laplace transform, Analysis of electrical circuits using Laplace	09

5	Transform. **Network Functions:** Terminal pairs or ports, network functions for one port and two port networks, calculation of network functions. Concept of poles & zeros, Time domain behavior from pole-zero plots, Stability, Routh – Hurwitz criterion.	
6	**Two Port Network:** Z and Y parameters, input and output impedance in terms of two port parameters, Relation between Z and Y parameters, Introduction to ABCD and h-parameters.	04
7	**Network synthesis:** Properties of positive real function, Restrictions on poles &zeros for driving point function and transfer function, Driving point synthesis of LC, RC and RL networks, Foster and Cauer forms of realization.	06

Text Books
1. M.E. Van Valkenburg: Network Analysis. Prentice-Hall of India Pvt. Limited, Eastern Economy Edition. 2. Roy Chaudhary D.: Networks &Systems, New Age International Publisher
Reference Books
1. W. H. Hayt and J. E. Kemmerly: Engineering Circuits Analysis, Tata-McGraw HILL Publicatio. 2. Chakrabarti A.: Circuit Theory (Analysis &Synthesis), Dhanpat Rai &Co. 3. Schaum's Outline Series: Electrical network. 4. M.E. Van Valkenburg: Introduction to Modern Network Synthesis, Wiley Eastern Limited

Sr. No.	Examination	Module
1	T-I	1,2,3
2	T-II	3, 4
3	End Sem	1-7

Course Code	Course Name
PC-BTE303	**Digital Electronics**

Course pre-requisites	BEE

Course Objectives		
The objectives of this course are 1. Understand the number systems and coding. 2. Discuss the features of combinational circuits. 3. Understand flip flops and their applications. 4. Remember different logic families, their interfacing and memories		
Course Outcomes		
Upon successful completion of the course, students should be able to 1. Differentiate between number systems and classify different binary codes. 2. Analyze and design combinational circuits and Sequential circuits. 3. Solve problems using Finite state machines. 4. Classify different logic families and memories.		
Course Content		
Module No.	***Details***	***Hrs.***
1	Number System and Codes: Binary, Octal, Hexadecimal number systems, Conversion from one system to another, Binary Arithmetic. BCD, GRAY, Alphanumeric codes, Error detecting codes-odd and even parity, error detecting and correcting codes-Hamming Codes	**04**
2	Combinational circuits: Derive Gates, Max terms, Min terms, SOP and POS implementation, K-Maps and their use in simplifying Boolean expressions, Implementing a logic function using universal Gates.	**04**
3	Combination Logic Circuit Design: (i) Adders, Subtractors (Half and Full), carry look ahead adder, serial adder, magnitude comparators (ii) Arithmetic logic units, multiplexers, demultiplexers parity encoder, code converter. Hazards in Combinational circuits.	**08**
4	Sequential Logic Circuits: Comparison of combinational and sequential circuits, Flip-flops: SR, T, D, JK, converting one flip flop to another. Counter: Ripple counter, up-down counter, Synchronous counter, and designing of counters, state transition diagram, unused states and locked conditions.	**08**
5	Registers: SISO, SIPO, PISO, PIPO registers, ring counter, twisted ring counter, pseudorandom sequence generator.	**04**
6	Logic Families: Characteristics of digital logic families, TTL, CMOS logic, interfacing	**06**

	CMOS and TTL, Tri- state logic. Semiconductor memories : Content addressable memory (CAM), ROM as a PLD, Programmable logic array, Programmable array logic.	
7	Introduction to finite state machine: State table, state diagram, next state analysis, Mealy and Moore state machines. State machine reduction.	**08**

For Self-Study: Memory organization and operation, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM)

Text Books
1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016
Reference Books
1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. William I. Fletcher, „An Engineering Approach to Digital Design", PHI.

Sr. No.	Examination	Module
1	T-I	1,2,3(i)
2	T-II	3(i),4
3	End Sem	01-07

Course Code	Course Name

PC-BTE304	**Electromagnetic Field and Waves**
Course pre-requisites	Basic Electrical engineering

Course Objectives

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on concepts of electrostatics, electric potential, energy density and its applications.
3. To impart knowledge on concepts of magneto statics, magnetic flux density, scalar and vector magnetic potential and its applications.
4. Explain time varying electric and magnetic fields and wave theory

Course Outcomes

Upon successful completion of the course, students should be able to

1. Interpret electromagnetic field data and identify the parameters that affect it.
2. Interpret and apply Maxwell's equations to analyze electromagnetic phenomena.
3. Solve problems involving the behavior of charged particles in electric and magnetic fields.
4. Apply mathematical techniques and electromagnetic field theory to analyze and design simple electromagnetic systems.

Course Content

Module No.	***Details***	***Hrs.***
1	**Review of Vector Calculus** Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, Three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, Partial differentiation, integration, vector operator del, gradient, divergence and curl, Conversion of a vector from one coordinate system to another.	06
2	**Static Electric Field** Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density	07
3	**Conductors, Dielectrics and Capacitance** Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.	06
4	**Static Magnetic Fields**	07

	Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors	
5	**Magnetic Forces, Materials and Inductance** Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.	06
6	**Time Varying Fields and Maxwell's Equations** Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.	05
7	**Electromagnetic Waves** Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Poynting theorem	05

Text Books:

1. W. Hayt , "Engineering electromagnetic", 8th Edition, McGraw Hill publication, 2012
2. E. C. Jordan & K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2 nd edition, Pearson Education, 2015
3. R. K. Shevgaonkar "Electromagnetic waves" , McGraw-Hill Education (India) Pvt. Limited, 2006

Reference Books:

1. Edminister, "Schaum's series in electromagnetic",3rd Edition, McGraw Hill publications,1989
2. N. Narayan Rao, "Elements of electromagnetic",4th Edition, PHI publication, 2001
3. S. Seely, "Introduction to electromagnetic fields", McGraw Hill,1958
4. David K. Cheng, "Field and electromagnetic", 2nd Edition, Addison Wesley,1999
5. Corson and Lerrain, "Electromagnetic", 2nd Edition, CBS publications,1986

Evaluation:

Sr No.	Name of the exam	Total marks	Modules
1	T-I	20	1,2,3
2	T-II	20	3,4
3	End semester examination	100	1-7

Course Code	Course Name

PC-BTE351	**Electronic Circuit Laboratory**

Course pre-requisites	

Course Objectives

The objectives of this course are

1. Analysis of transistors, practical applications of Op-amp, oscillators.
2. Working of Differential amplifier, calculation of CMRR
3. Use IC 555 as mono-stable and a stable multi-vibrator.
4. Effect of negative feedback on amplifiers.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Calculate gain, BW of transistors.
2. Calculate CMRR of differential amplifier, Select appropriate electronic components to design various op-amp circuits depending on application required, to select appropriate components to design oscillator
3. Able to select component values for astable and mono-stable multi-vibrators using IC 555
4. Write and present project report in a team.

Course Content

Module No.	***Details***	***Hrs.***
1	Differential Amplifier	02
2	Transfer Characteristics of op-amp	02
3	V to I converter	02
4	Integrator	02
5	Differentiator	02
6	Schmitt Trigger	02
7	Instrumentation Amplifier	02
8	Astable multi-vibrator using 555	02
9	Mono-stable multi-vibrator using 555	02
10	Wein Bridge Oscillator	02
11	RC phase shift Oscillator	02
12	Calculation of gain, BW of the transistor.	02

Term Work

Term work shall comprise of

1. Practical examination/ MCQ Examination based on any 8 experiments performed from the above list.
2. Mini Project*

*Mini Project: There will be a course mini project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of four to five students. The group has to present the project and submit the project report

Text Books

5. Robert Boylestad and Louis Nashelsky, „Electronic devices and circuits theory ", 11th edition Pearson 2017

6. Donald A. Neamen,"Electronic Circuits Analysis and Design",. (SIE) | 3rd edition 2006
7. Gayakwad Ramakant,"Op-Amps and Linear Integrated Circuits", Pearson 2015
8. D. Roy Choudhari and Shail B. Jain," Linear Integrated Circuits", New age International Publishers, 4th edition, 2018

Reference Books

1. Bhargava,Kulshreshtha,Gupta:„Basic Electronics and Linear Circuits" NITTTR Chandigarh,2nd edition, 2013.
2. David Bell, Electronic Devices and Circuits",5thEdition,Oxford University Press, 2008
3. Allen Mottershead,"Electronic Devices and Circuits an introduction", Prentice Hall of India, 1979
4. K.R.Botkar,"IntegratedCircuits",KhannaPublication, 10th edition, 1987

Course Code	Course Name
PC-BTE352	**Electrical Network Laboratory**

Course pre-requisites	Basic Electrical Engineering

Course Objectives

The objectives of this course are

1. Introduction to MATLAB / SCILAB/ e-sim/ Pspice/ SEQUEL software for circuit analysis.
2. To simulate electrical circuits using simulation software.
3. Gain practical experience on simulation and working of electrical circuits.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Evaluate steady state and transient state response of DC and AC electrical circuits.
2. Analyze DC/AC electrical circuits through simulation software.
3. Analyze DC/AC electrical circuits through experimental setup.

Course Content

Module No.	***Details***	***Hrs.***
1	DC network Simulation	02
2	AC network Simulation	02
3	Transient Response of RL, RC and RLC network for step input voltage (through Simulation)	02
4	Transient and steady state Response of RL, RC and RLC network for sinusoidal input voltage (through Simulation)	02
5	Transient Response of RL, RC and RLC network using hardware setup.	02
6	Series resonance	02
7	Obtaining response of a given electrical network using transfer function (Code).	02
8	Network analysis using graph theory (Code)	02
9	Pole – zero plot of a given transfer function	02

List of Class Assignments

1	DC networks Theorems
2	AC networks Theorems
3	Graph Theory
4	Time domain analysis of RLC circuits
5	Laplace Transform and analysis of RLC circuits
6	Network functions and two port networks
7	Network Synthesis

Reference Books

1. M.E. Van Valkenburg: Network Analysis. Prentice-Hall of IndiaPvt. Limited, Eastern Economy Edition.
2. Roy Chaudhary D.: Networks &Systems, New Age international publisher
3. W. H. Hayt,and J. E. Kemmerly: Engineering Circuits Analysis, Tata-McGraw HILL Publication.
4. Chakrabarti A.: Circuit Theory (Analysis &Synthesis), Dhanpat Rai &Co.
5. Schaum‟s Outline Series: Electrical network.
6. M.E. Van Valkenburg: Introduction to Modern Network Synthesis, Wiley Eastern Limited

Course Code	Course Name

PC-BTE353	**Digital Electronics Laboratory**
Course pre-requisites	

Course Objectives

The objectives of this course are

1. Understand the basics of circuit making on bread board
2. Test the working of the circuit
3. Introduce simulation using software
4. Learn to develop application based on digital electronics circuits.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Design combinational and sequential circuits using discrete components.
2. Test the designed circuit to get required output.
3. Simulate complex combinational and sequential circuits.
4. Write and present project report in a team.

Course Content

Module No.	***Details***	***Hrs.***
1	Logic Expressions simplification and implementation.	02
2	Half Adder and Half subtractor using gate IC‟s	02
3	Code Converter: Binary to Gray, BCD to XS-3.	02
4	IC7483 as 4bit adder and subtractor	02
5	Multiplexer 4:1 using gates.	02
6	Simulate De-multiplexer1:16 internal Gate circuit.	02
7	Flip-Flops: S-R, J-K, D, T using gates.	02
8	BCD Counter implementation using Flip Flops.	02
9	Simulation of Ring Counter, Twisted Ring Counter.	02
10	PLD Simulation	02

Term Work

Term work shall comprise of

1. Practical examination/ MCQ Examination
2. Mini Project*

*Mini Project: There will be a course mini project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of Four to Five students. The group has to present the project and submit the project report

Text Books

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016

Reference Books

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. William I. Fletcher, „An Engineering Approach to Digital Design‟, PHI.

Course Code	Course Name
PC-BTE354	**Electromagnetic Field and Waves Laboratory**
Course pre-requisites	

Course Objectives

The objectives of this course are

1. To understand and concept of vector addition, vector calculus, co-ordinate systems, static and time varying fields and electromagnetic waves more precisely by visualize aid.
2. To familiarize the students by introducing FEMM-4.2 simulation software and help them to Simulate and analyze different Electromagnetic circuit

Course Outcomes

Upon successful completion of the course, students should be able to

1. Understand concepts of vector calculus and underlying theories in electrostatics, magneto statics, and time-varying electromagnetic fields using field plots generated by formulae and Finite Element Method (FEM) based computations.
2. Apply knowledge of electromagnetic fields in real time application.
3. Analysis of effect electromagnetic field in electromagnetic circuits.
4. Build and simulate core electromagnetic circuits and power apparatus using FEMM S/W.

Course Content

Module No.	*Details*	*Hrs.*
1	Addition & Products of two vectors.	02
2	Coordinate systems (Cartesian, Cylindrical and Spherical).	02
3	Position vector and distance vector.	02
4	Curl, Divergence and gradient of a field.	02
5	Variation of electrostatic fields.	02
6	Curl free static electric field.	02
7	Variation of electrostatic fields over multiple dielectric materials.	02
8	Electric flux density.	02
9	Force on a single current carrying conductor.	02
10	Force between two current carrying conductors.	02
11	Magnetic vector potential.	02
12	Variations of time varying field.	02

Term Work

Term work shall comprise of Practical Examination/ MCQ examination

Text Books

1. W.Hayt, “Engineering electromagnetic”, McGraw Hill.
2. E.C.Jordan &K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, Prentice Hall of India.

Reference Books

1. Edminister, “Schaum’s series in electromagnetic”, McGraw Hill publications.
2. N.NarayanRao, “Elements of electromagnetic”, PHI publication.
3. S.seely, “Introduction to electromagnetic fields”, McGraw Hill.
4. David K. cheng, “Field and electromagnetic”, Addison Wesley.

5. Corson and lerrain, "Electromagnetic", CBS publications

Course Code	Course Name
HS-BTE301	**Organizational Communication and Interpersonal Skills**

Course pre-requisites	Communication Skills Semester II

Course Objectives

The objectives of this course are

1. To enhance effective corporate communication through professional writing
2. To prepare students for successful career that meets the corporate, industrial and global requirement.
3. To enable students to communicate in professional environment and social context with knowledge of professional etiquette, and understand social responsibilities with multi-disciplinary approach, in all tasks of life.
4. To discern and develop effective organizational writing.
5. To inculcate in students professional and ethical attitude at the workplace and develop an ability to imbibe effective interpersonal skills.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Develop professional communication using precise language and formats.
2. Apply the traits of a suitable candidate for a job/ higher education, through training and participation in group discussions, facing interviews and writing resume/ SOP.
3. Demonstrate awareness of corporate etiquette and knowledge of professional responsibilities.
4. Design technical documents using precise and objective language, apt for organizational communication.
5. Deliver formal presentations effectively and develop life skills/ interpersonal skills to progress professionally by building stronger relationships in the society.

Course Content

Module No.	*Details*	*Hrs.*
1	Business writing • Types of meetings, Notice, Agenda, Minutes of the meetings, Strategies for conducting effective meetings.	03
2	Employment Skills: • Group Discussion • SWOT Analysis • Resume Writing / Curriculum Vitae • Interview Skills • Statement of Purpose	10
3	Introduction to Corporate Etiquette and Core Values: • Etiquettes and rules of behavior • Professional Conduct, • Etiquette in Meetings (Netiquette) • Dining Etiquettes. • Core Values of an organization	04

4	Report writing: • Objectives of report writing, • Language and style in a report, • Types of reports. • Formats of reports: Memo, Letter, and Project report Survey based. ***(A Computer- aided presentation of the Project report)*** Proposal Writing: • Format and style. Technical Proposals: • Objectives of technical proposals, • Parts of proposals.	08
5	Interpersonal Communication and Soft Skills: • Creating and delivering effective presentations • Working and communication in teams • Leadership skills • Time management • Conflict resolution and negotiation skills	07

Term Work

Term work shall comprise of

1. . Meeting documentation: Role play and written assignment
2. Practical sessions on Group Discussion topics
3. Mock Interviews, Job application and resume writing.
4. Etiquettes case study and role play. MCQ's
5. Three assignments on report-writing.

(A Bound report to be submitted on research topic to be submitted in partial fulfillment of the syllabus Report Writing in a group of 8 to 10 students with a PowerPoint presentation, Report content will be graded and counted during presentation, a printed copy of the presentation and a soft copy in the form of CD to be attached with the report).

6. Technical Proposal (Group activity, document of the proposals, A proposal to be prepared by students in a Group of 5)
7. Interpersonal Skills: Case Studies, Group Activity and assignments
8. Presentations and seminar on module no. 4, 5 with Power point
9. Role play and videos taken by students.

Text Books

Sr. No	Text Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Report Writing for Business	Lesiker and Petit	Mc Graw Hill	10	1
2	Technical Writing for Professional Communication	Huckin and Olsen	Mc Graw Hill	2	1, 2
3	Personal development for Life and Work	Wallace and Masters	Thomson Learning	12	3,4,5,6

4	Effective Business Communication	Herta Murphy	Mc Graw Hill	7	1,2,3, 4,6
5	Organizational Behaviour	Fred Luthans	Mc Graw Hill	12	3,5
6	Business Correspondence and Report Writing	R.C. Sharma and Krishna Mohan	Tata McGraw Hill	2	1,2,4,6
7	Soft skills	Dr. K.Alex	S. Chand and company	3	3,5,6
8	Professional Ethics	R.Subramaniam	OUP		5
9	Organizational Behaviour	Robbins Stephens	Pearson Education	12	3

Reference Books

Sr. No	Reference Book Titles	Author/s	Publisher	Edition	Module Nos.
1	How to Speak Fluently	Jones	Indian Publishing House	1st	6
2	Speaking English Effectively	Krishna Mohan N.P. Singh	Macmillan	2nd	6
3	"Business Communication - Concepts Cases and Applications"	Chaturvedi and Chaturdevi	Pearson	2nd	5
4	"Communication Skills for Engineers"	Sunita Mishra and C. Murlikrishna	Pearson	1st	6
5	Business Communication- "Building Critical Skills"	Kitty O Locker	McGraw Hill	3rd	3, 4
6	"Body Language",	Alan Pease	Manjul Publications	18th	3, 4,6
7	"The Craft of Business Letter Writing"	Monipally	Tata McGraw Hill	1st	6
8	Soft Skills and Professional Communication	Francis Peter	Tata McGraw Hill	1st	3, 6

9	50 ways to improve your Business English	Ken Taylor	Summertown Publishing	1st	1, 5
10	50 ways to improve your Presentation Skills in English	Bob Dignen	Summer town Publishing	1st	6

E Books

Sr. No	E- Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Business Communication Today	Courtland L Bovee	Prentice Hall	--	3, 5, 6
2	Excellence in Business Communication	John Thill	Prentice Hall	6	4,
3	Business Communication: Building Critical Skills	Kitty O Locker	Mc Graw Hill	--	3

Sr. No.	Examination	Module
1	T-I	1.2
2	T-II	3,5
3	End Sem	1 to 5

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute under Mumbai University)
Andheri (W), Mumbai – 400058

COURSE CONTENTS

Sem. IV

S. Y. B.Tech. (ELECTRICAL) ENGINEERING

Academic Year: 2023-2024

List of Courses

BS-BTE401 Transforms, Statistics and Probability

PC-BTE401 Power Generation, Transmission & Distribution

PC-BTE402 Power Electronics

PC-BTE.403 Electrical Machines-I

PC-BTE404 Microprocessor and Microcontroller

PC-BTE405 Signals and Systems

PC-BTE452 Power Electronics Laboratory

PC-BTE453 Electrical Machines I Laboratory

PC-BTE454 Microprocessor and Microcontroller Laboratory

PC-BTE455 Signals and systems Laboratory

MC-BTE002 Indian Traditional Knowledge

VA-BTExxx Value Added courses (Refer Appendix I)

Course Code	Course Name
BS-BTE401	**Transforms, Statistics and Probability**

Course pre-requisites	DCCN(BS-BT101) , ICDE(BS-BT201) , LVCLA(BS-BTE301)

Course Objectives

The objectives of this course are
1. Introduce Fourier series
2. Introduce Fourier transforms & Z-transforms
3. Introduce Hypothesis testing
4. Introduce Statistical methods, probability distribution

Course Outcomes

Upon successful completion of the course, students should be able
1. Solve problems on Fourier series
2. Solve problems based on Fourier transforms & Z-transforms
3. Solve problem in basic statistics, probability, probability distribution
4. Solve problems based on testing of hypothesis

Course Content

Module No.	*Details*	*Hrs.*
1	**Fourier Series & Integrals** Orthogonal & Orthonormal set of functions. Fourier series, Determination of Fourier constants, Dirichlets conditions. Fourier series for $f(x)$, $x \in [c, c+2\pi]$ and $x \in [c, c+2L]$, Parseval's Identity. **Fourier Series half range & complex form** Fourier series of Odd and Even functions Half range Fourier Sine & Cosine series, Parseval's Identity Complex form of Fourier series	06
2	**Fourier Transform & Z-Transforms** Fourier Integral theorem. Fourier Sine and Cosine integrals. Inversion formulae of Fourier transform. Z-transforms introduction, Sequences, ROC,Standard functions, Properties. Inverse Z-transforms	06
3	**Statistics:** Correlation, Karl Pearson coefficient &Spearman's rank Correlation coefficient, linear regression, lines of regression.	04
4	**Discrete Random Variables:** Random variables, Probability distribution for discrete random variables, Expected value and Variance, Binomial Distribution and Poisson Distribution	06
5	**Continuous Random Variables:** Probability Density Function for continuous random variable, Normal Distribution	06
6	**Sampling Theory:** Sampling distribution. Test of Hypothesis. Level of significance, critical region. Large and Small Samples. Test of significance for Large Samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples. Test for significance of the difference between sample S.D and population S.D, Test for significance of the	07

	difference between the S.D of two samples.	
7	**T-Test:** Student's t-distribution and its properties. Test of significance of small samples. Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples, Chi-square distribution and its properties.	07
Term Work		
Term work shall comprise of A total of 10 tutorials to be taken batch wise covering the entire syllabus.		

Text Books
1. B S Grewal, "Higher Engineering Mathematics", Khanna Publications. 2. H.K.Das. "Advanced Engineering Mathematics", S.Chand Publication. 3. Murray Spiegel. "Probability and Statistics" Schaum's Outline Series.
Reference Books
1. B. V. Ramanna. "Higher Engineering Mathematics" Tata Mc-Graw Hill Publication. 2. N.P.Bali. "Text book of Engineering Mathematics", Laxmi Publications. 3. R. K. Jain and S.R.K. Iyenger. "Advanced Engineering Mathematics", Narosa Publication.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

Course Code	Course Name
PC-BTE401	**Power Generation, Transmission & Distribution**
Course pre-requisites	Basic Electrical Engineering, Electrical Network

Course Objectives

The objectives of this course are

1. To make student understand basic structure and requirements of any electric power supply system.
2. To impart knowledge about modelling of various power system components.
3. To make student realize the need of earthing & safety techniques

Course Outcomes

At the end of the course, students will demonstrate the ability to

1. Explain structure of power system, load patterns and various generation, storage techniques.
2. Model power system equipments and evaluate their performance under steady state.
3. Understand and appreciate the need of earthing and neutral grounding for power system equipments.
4. Identify various components and structure of distribution system.

Course Content

Module No.	*Details*	*Hrs.*
1	**Basic structure of power system:** Single Line diagram, Generation, transmission and distribution voltage levels, Power system scenario in India, concept of regional and National GRID. **Review of AC systems:** Complex power in single phase and three phase systems, power factor correction, Star and delta connections, phasor diagram for balanced and unbalanced load. **Basic Economics of power system:** Load curves, connected load, maximum demand, demand factor, Average load, load factor, diversity factor, Tariff, Introduction to demand side management.	4
2	**Energy Generation & Storage-** overview and comparative study of conventional and renewable power generation, Environmental and economic impact. Battery storage, types of batteries, different battery materials, Mechanical storage (flywheel, pump storage, PHS &CAES), Electrostatic & electromagnetic storage, UPS.	6
3	**Transmission Systems:** Transmission line resistance and shunt conductance, skin effect, proximity Effect, Electrical and Magnetic Fields around conductors, Corona Effect, Inductance and capacitance calculations for different configurations of single phase and three phase line with composite & bundled conductors. Cables and wires: theory, design and construction, cable laying methods, concept of cable derating.	6

4	**Models and Performance of Transmission Line:** Steady state representation of lines: short, medium and long line models and performance evaluation, voltage and current waves, surge impedance loading (SIL), concept of lossless line, voltage, current profiles under different loading conditions, Ferranti Effect, shunt and series compensation.	8
5	**Modelling of Transformer, Synchronous Machine & Loads:** Steady state representation of power transformer: Three-phase connections and star delta phase-shifts. Single phase equivalent of three-phase transformers. Three-winding transformers, autotransformers, Synchronous Machine: equivalent circuit, operation when connected to infinite bus, power angle characteristics. Load models : constant power, constant current & constant impedance loads	6
6	**Earthing & Neutral Grounding in power system:** Soil resistivity, earth resistance, Tolerable limit of body currents- tolerable step and touch voltage-actual step and touch voltage, Design of earthing grid-concrete encased electrodes and tower footing Resistance, Measurement of earth resistance, soil resistivity, Impulse behavior of Earthing. Overvoltage due to ungrounded neutral, methods of neutral grounding.	6
7	**Electrical Distribution Systems** Structure of Distribution System, Components of Distribution System Substation and Busbar Layouts, Feeder Configurations, Nature of Loads in a Distribution System, Distribution transformer loading, various Load Allocation techniques.	6

For Self-study: Mechanical Design of O/H Transmission systems:
Types of towers, conductor configuration, spacing and clearance, span lengths, sag & tension, Types of insulator, Voltage distribution over insulator string, methods to improve string efficiency.

Text Books:

1. Saadat Hadi, "Power System Analysis, "TMH Publication.
2. Kothari D. P Nagrath I. J., "Modern Power System Analysis", TMH Publications.
3. Wadhawa C. L., "Electrical Power Systems", New Age International.
4. B. R. Gupta, "Power system Analysis and Design", S. Chand Publications
5. A. A. Sallam and O. P. Malik, "Electric Distribution System", IEEE Press, Piscataway, NJ, 2011.

Reference Books:

1. Prabha Kundur, "Power System Stability and Control'', TMH Publication.
2. Olle I. Elgerd, "Electric Energy Systems Theory: an Introduction", TMH Publication
3. IEEE 80 – IEEE guide for safety in substation grounding
4. Dr. K. Rajamani, "Application Guide for Power Engineers Part 1 Earthing & Grounding of Electrical systems", Notion Press.
5. W. H. Kresting, "Distribution System Modeling and Analysis", CRC Press, New York, 2002.

E resources (if any):

Course Code	Course Name
PC-BTE 402	**Power Electronics**
Course pre-requisites	BEE-I, BEE-II

Course Objectives

1. Explain controlled converters
2. Analyze current and voltage inverters and demonstrate the operation and control of inverter circuits
3. Discuss DC to DC converters and AC voltage controllers
4. Discuss need and application of AC filter

Course Outcomes

1. Demonstrate the behavior of semiconductor devices as a power switch
2. Apply the control techniques of rectifiers and inverters and their filtering requirements
3. Analyze AC to DC, DC to AC, DC to DC and AC to AC converters

Course Content

Module Number	Details	hours
1.	Silicon Controlled Rectifiers: Principle of operation of SCR, Static & Dynamic characteristics, Gate characteristics, pulse firing. Snubber circuits.	3
2.	Controlled Switching Devices: Principle of operation, rating and applications of power transistors, IGBT and MOSFET and power diodes.	5
3.	Rectifiers: Introduction to Half wave uncontrolled and controlled rectifiers with different loads, Full wave controlled rectifiers with different loads (single phase and three phase) Power factor improvements in rectifiers. Effect of load and source inductances	10
4.	Inverters: i. Principle of operation, Performance parameters, Single phase bridge Inverters with RL and pure L load. 3 phase bridge Inverters: 180 degree conduction mode. ii. Voltage control of single phase and three phase inverters using PWM techniques, Connection of three phase inverter to grid, concept of active and reactive power flow between inverter and grid iii. Current source inverters	10
5.	Passive Filters: causes of harmonic generation, filter requirement of power electronics converters, grid connected converter, selection of inductor and capacitor, performance parameters	4
6.	Switching mode regulators – Buck, Boost, Buck-Boost and Cuk regulators, Bi-directional Chopper	6
7.	AC Voltage Controllers: Principle of Phase Control, Single Phase bidirectional control with R-L load, Three phase AC voltage regulators	4

For Self-study: Study of fully semiconductor switches: Triac, IGCT, GTO, SGTO. Comparison of semiconductor devices. Introduction to requirement of heat sink in semiconductor switches

E resources: http://www.digimat.in/nptel/courses/video/108101038/L01.html

Text Books
1. Mohan, Undeland and Riobbins, 'Power Electronics Converters, Applications and Design'. Wiley student third edition. (2022) 2. Muhammad Rashid, 'Power Electronics, Circuits, Devices and Applications'. Pearson, fourth Edition (2017). 3. Daniel Hart, 'Power Electronics'. McGraw Hill, Indian Edition. (2017) 4. L. Umanand, 'Power electronics essentials and applications' Wiley India (2009) 5. Soumitra Kumar Mandal, Power Electronics. McGraw Hill Education (2014) 6. Bimbra P.S. 'Power Electronics'. Khanna Publishers (2018)
Reference Books and standards
1. B. K. Bose, 'Power Electronics and AC Drives', Pearson (2001) 2. P.C. Sen, ' Principles of electrical machines and power electronics', Wiley India (2013) 3. IEEE-519-2014 Harmonic control standard in Electric power system

Course Code	Course Name
PC-BTE 403	**Electrical Machines-I**
Course pre-requisites	Electromagnetic field theory, Electrical Networks

Course Objectives

1. Discuss the concepts of magnetic field, magnetic circuits, electromagnetic force and torque.
2. Comprehensive analysis of DC machines and transformers

Course Outcomes

1. Apply the concepts of magnetic circuits in rotating machine and transformers.
2. Examine the differences in operation of different dc machine configurations.
3. Analyze and evaluate the performance of different transformers

Course Content

Module No.	***Details***	***Hrs.***
1	Magnetic fields and magnetic circuits: Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	4
2	Electromagnetic force and torque: B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits	3
3	Linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element.	4
4	DC machines : EMF equation, Armature winding and commutation- Derivation of torque equation, armature reaction	4
5	DC machine - motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, V-I characteristics and torque-speed characteristics of DC machines. **Factors affecting machine performance.**	6
6	Transformers: Principle of operation of single phase and three phase transformers, Equivalent circuit, Phasor diagram, O.C. and S.C. test: Efficiency and regulation, Transformer Vector Groups, Parallel operation of transformers	11
7	Excitation phenomenon in transformers: Transformer harmonics, Oscillating neutral, Transformer switching current transient, Autotransformers, Tap changing transformers. High Frequency Transformers (HFT): Basic Principle - construction – Application of HFT. Factors affecting machine transformer performance.	10

For Self-study: Different types of HFT and their constructions and comparison

E resources: http://www.digimat.in/nptel/courses/video/108102146/L01.html

Text Books:

1. P.C.Sen, Principles of Electric Machines and Power Electronics Wiley India Pvt Ltd.
2. A. E. Fitzgerald, Charles Kingsley, Jr., Stephen D. Umans 'Electric Machinery', McGraw Hill, sixth edition
3. P.S.Bimbra, 'Electrical Machinery', by Khanna Publisher
4. Nagrath I. J., Kothari D.P., 'Electric Machines', TMH Publication.

Reference Books:

1. P.S. Bimbra, 'Generalized theory of Electrical Machines', Khanna Publisher..
2. Ashfaq Husain,' Electric Machines', Dhanpat Rai and Sons, second edition, 2017

Course Code	Course Name
PC-BTE404	**Microprocessor and Microcontroller**

Course pre-requisites	Digital Electronics

Course Objectives

The objectives of this course are

1. To understand the difference between of Microprocessors & Microcontrollers
2. To understand architecture and features of typical Microcontroller.
3. To learn interfacing of memory and I/O.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Explain The 8051 Architecture
2. Know various instructions, addressing modes and hence do assembly language programming.
3. Be able to do interfacing of peripherals with microcontroller.

Course Content

Module No.	***Details***	***Hrs.***
1	**Fundamentals of Microprocessors:** Fundamentals of Microprocessor Architecture. 8- bit Microprocessor and Microcontroller architecture, Comparison of 8-bit, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.	06
2	**The 8051 Architecture** Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles	06
3	**Instruction Set and Programming I** Addressing modes: Introduction, Instruction syntax, Data addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set,	06
	Instruction Set and Programming II	06

4	Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.	
5	**Memory and I/O Interfacing** Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices	08
6	External Communication Interface Synchronous and Asynchronous Communication. RS232, SPI, I2C.	05
7	**Applications** LED, LCD and keyboard interfacing. Stepper motor interfacing.	05

For Self-Study : Applications of 8051 DC Motor interfacing and sensor interfacing
Introduction and interfacing to protocols like Blue-tooth and Zig-bee.

Text Books

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and applications with 8085", Penram International Publication 6th edition, 2013.
2. Muhammad Ali Mazidi, "The 8051 Microcontrollers and Embedded Systems using Assembly and C", Pearson 2nd edition, .2007

Reference Books

1. Mano M., "Computer System and Architecture", Pearson, 3rd edition, 2017.
2. William Stallings, " Computer Organization and Architecture", Pearson, 11th edition, 2022
3. A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 3rd h edition, 2017
4. Kenneth J .Ayala," The 8051 Microcontroller Architecture, Programming, and applications ", Penram Publishers, 1991

Sr. No.	Examination	Module
1	T-I	1,2
2	T-II	3,4
3	End Sem	01-07

Course Code	Course Name
PC-BTE405	**Signals and Systems**

Course pre-requisites	Basic Electrical Engineering, Laplace Transform, Fourier Series

Course Objectives

The objectives of this course are

1. To introduce the concepts of signals and systems.
2. To discuss different analysis tools (Fourier Series, Fourier Transform, Laplace Transform and Z Transform) and their properties.
3. To carry out analysis and synthesis of both continuous-time and discrete time systems both in time domain and transformed domain using different transforms and applied mathematics concepts

Course Outcomes

Upon successful completion of the course, students should be able to

1. Characterize CT and DT signals and systems.
2. Analyze DT systems in Time domain and using Z-Transform.
3. Analyze CT signals using Fourier analysis tools, CTFS and CTFT.
4. Analyze CT system using Fourier and Laplace transform.

Course Content

Mod No.	*Details*	*Hrs.*
1	**Introduction to Signals and Systems** Definition of basic signals such as impulse, unit step, unit ramp, Analog to digital conversion of signal, basic discrete time signals. Classification of signals, Signal operations. Concept of a Continuous time (CT) and Discrete time(DT) system, properties and classification of systems, Examples of CT and DT system models, modeling of electrical circuit models such as RL circuit.	06
2	**Discrete time LTI Systems** Introduction FIR and IIR Systems, Discrete convolution and correlation, properties of convolution, Solution of linear constant coefficient difference equation, Zero input and zero state response.	06
3	**Fourier Series and Fourier Transform** Introduction, Trigonometric and exponential Fourier Series, Parseval's theorem for Fourier Series, Power Spectrum of a Periodic Function. Fourier Transform, Properties of Fourier Transform such as Linearity, Symmetry, Scaling, Convolution, Time shifting, Frequency shifting, Fourier transform of some important signals such as rectangular, triangular, exponential, Gaussian pulse, energy spectrum. System analysis of CT system, frequency response of a CT system, Introduction to DTFS and DTFT. **Laplace Transform & its applications to System Analysis**	06

		06
4	Introduction, Definition, ROC, Laplace Transform of basic signals, Laplace transform of periodic signals, Initial and Final value theorem, Partial fraction expansions, application to system analysis, transfer function, poles and zeros, stability in s-domain.	
	Z-Transform	06
5	Introduction, Definition, one sided and two sided z-transform, ROC, Properties of ROC, Properties of z-transform. Inverse z- Transform using methods such as long division, partial fraction expansion and residue method.	
	Analysis of LTI systems using z-Transform	06
6	Solution of linear constant coefficient difference equation using method of z-Transform, transfer function, impulse response and step response, Pole - zero concepts, stability criterion for systems, Relation between s- plane and z-plane.	
	Realization of Linear Systems	06
7	Basic realization block diagram of CT and DT system. Basic structures of FIR Systems Basic structures for IIR Systems: Direct form – I, direct form – II, series, parallel.	

Text Books
1. Alan V. Oppenheim, Alan V. Willsky and S.Hamid Nawab, “Signals and Systems”, Prentice-Hall India. 2. Mrinal Mandal and Amir Asif, “Continous and Discrete Time Signals and Systems”, Cambrige International Student Edition, Tata McGraw-Hill. 3. Haykin S and Van Veen B., “Signal & Systems”, Wiley Publication, 2nd Ed.,2002. 4. Hwei P. Hsu, SCHAUM'S OUTLINES OF “Theory and Problems of Signals and Systems”, McGraw-Hill International.
Reference Books
1. Nagrath I. J., Sharan S. N. and Ranjan R., “Signal & Systems”, 2nd Ed., 2010. 2. Narayan Iyer, “Signal & Systems”, Cengage Learning, 2011. 3. Lindner D.K., “Introduction to Signal & Systems”, McGraw-Hill International Edition, 1999. 4. Ambardar, “Analog & Digital Signal Processing”, Thomson learning, 2nd Ed. 5. Proakis J.G. and Manolakis D. G., “Digital Signal Processing: Principles, Algorithms and applications”, PHI publications (1995). 6. Lathi B.P., “Signal & Systems”, Oxford University Press, second edition, 1998.

Sr. No.	Examination	Module
1	T-I	1,2,3
2	T-II	3, 4
3	End Sem	1-7

Course Code	Course Name
PE-BTE 452	**Power Electronics Lab**
Course pre-requisites	Basic electrical and electronics lab

Course Objectives

1. To simulate various converter circuits.
2. To familiarize the students by introducing software simulation and help them to Simulate and analyze different Converters

Course Outcomes

1. Simulate uncontrolled and controlled converters
2. Observe and analyze various rectifier waveforms for different loads with different firing angles.
3. Demonstrate the variation in magnitude of voltage and frequency in inverter circuits with control techniques

Module No.	***Details***	***Hrs.***
1.	Half wave uncontrolled and controlled converter with Rand RL load.	2
2.	Different methods of SCR firing.	2
3.	Single phase Full wave fully controlled SCR converter with resistive load	2
4.	Single phase Full wave fully controlled SCR converter with RL load.	2
5.	Three phase full wave fully controlled SCR converter with resistive load	2
6.	Single phase Current Source Inverter with R-load.	2
7.	Software simulations of three phase inverters with R load	2
8.	Software simulations of three phase inverters with R-L load	2
9.	Software simulations of DC to DC converters. Comparison with ideal converter and practical converter (particularly boost converter)	2
10.	Mini project	

Term work shall comprise of Practical Examination/ MCQ examination/ mini project

Mini project: Use of Power electronics switches in practical applications**.**
Understanding bread board limitations

Text Books
1. Mohan, Undeland and Riobbins, 'Power Electronics Converters, Applications and Design'. Wiley student third edition. (2022) 2. Muhammad Rashid, 'Power Electronics, Circuits, Devices and Applications'. Pearson, fourth Edition (2017). 3. Daniel Hart, 'Power Electronics'. McGraw Hill, Indian Edition. (2017) 4. L. Umanand, 'Power electronics essentials and applications' Wiley India (2009) 5. Soumitra Kumar Mandal, Power Electronics. McGraw Hill Education (2014) 6. Bimbra P.S. 'Power Electronics'. Khanna Publishers (2018)
Reference Books and standards
1. B. K. Bose, 'Power Electronics and AC Drives', Pearson (2001) 2. P.C. Sen, ' Principles of electrical machines and power electronics', Wiley India (2013) 3. IEEE-519-2014 Harmonic control standard in Electric power system

Course Code	Course Name
PC-BTE 453	**Electrical Machines-I Lab**
Course pre-requisites	Basics of Electrical Engineering

Course Objectives

1. Understand concepts of electromagnetics through simulations
2. Demonstrate construction of different machines.
3. Conduct experiment to evaluate performance of single phase and three phase transformer.
4. Conduct experiment to evaluate performance of DC shunt motor

Course Outcomes

1. Verify concepts of electromagnetics using software simulation
2. Determine the performance characteristics of DC machines
3. Evaluate the performance of transformer.
4. Observe the effect of load variation on the performance of DC motor and transformer

Course Content

Expt. No.	***Details***	***Hrs.***
1.	Simulation 1 based on Magnetic fields and magnetic circuits	2
2.	Simulation 2 based on Electromagnetic force and torque	2
3.	Demonstration on construction of transformer and DC machines	2
4.	To study speed control of DC Shunt Motor	2
5.	To perform load test on DC Shunt Motor.	2
6.	To study speed control of DC Series Motor	2
7.	To perform open circuit and short circuit test on 1 Phase Transformer	2
8.	To perform load test on 1 Phase Transformer	2
9.	To perform open circuit and short circuit test on 3 Phase Transformer	2
10.	To study parallel operation of two single phase transformer.	2
11.	To connect two winding transformer as a autotransformer	2
12.	General machine model for developing different kind of machines	2

Term Work: Term work shall comprise of 1. Practical Examination/ MCQ examination/ Mini project
Mini project on topics like: HFT applications, speed control of DC motor.
Activity: Visit to Machine Industry.
Reference Books:

1. P.C.Sen, Principles of Electric Machines and Power Electronics Wiley India Pvt Ltd.
2. A. E. Fitzgerald, Charles Kingsley, Jr., Stephen D. Umans 'Electric Machinery', McGraw Hill, sixth edition
3. P.S.Bimbra, 'Electrical Machinery', by Khanna Publisher
4. NagrathI.J., Kothari D.P., 'Electric Machines', TMH Publication.
5. P.S.Bimbra, 'Generalized theory of Electrical Machines', Khanna Publisher.

Course Code	Course Name
PC-BTE454	**Microprocessor and Microcontroller Laboratory**
Course pre-requisites	Digital Electronics

Course Objectives

The objectives of this course are

1. Study of instruction set and architecture of microprocessor and Microcontroller.
2. Study of external interface.
3. Learn to develop applications using microprocessor/ microcontroller.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Apply instruction set of microprocessor and Microcontroller.
2. Interface with external devices.
3. Write and present project report in a team.

Course Content

Module No.	***Details***	***Hrs.***
	Microprocessor	
1	Addition of Two 8-bit Numbers and Sum is 8-bit.	02
2	Addition of two 8 bit numbers and sum is 16-bit.	
3	Addition of Two 16-Bit Numbers and Sum is 16-bit.	
4	Decimal Addition of Two 8-Bit Numbers and Sum is 8-bit.	02
5	One's Complement and Two's Complement of an 8-bit Number	
	Microcontroller	
6	To add and subtract two 8 bit numbers using registers.	02
7	To multiply and divide two 8 bit numbers using register.	
8	Addition and subtraction of two numbers using DPTR.	02
9	Multiply and divide two numbers using DPTR.	
10	Count number of ones in a 8 bit number, maximum and minimum of numbers	02
11	Ascending /Descending order.	02
12	To perform read and write operation by 8255 interfacing	02
13	Interfacing of microcontroller to seven segment display.	02
14	Interfacing of microcontroller to D/A converters.	02

Term Work

Term work shall comprise of

1. Practical examination/ MCQ Examination
2. Mini Project*

*Mini Project: There will be a course mini project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of Four to Five students. The group has to present the project and submit the project report

Text Books

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and applications with 8085", Penram International Publication 6th edition, 2013.
2. Muhammad Ali Mazidi, "The 8051 Microcontrollers and Embedded Systems using Assembly and C", Pearson 2nd edition, .2007

Course Code	Course Name
PC-BTE455	**Signals and Systems Laboratory**

Course pre-requisites	

Course Objectives

The objectives of this course are to

4. Solve exercises for better understanding of the concepts.
5. Plot the signals.
6. Understand different in-built MATLAB functions related to signals and system.
7. Validate the theoretical results through simulation and experiments.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Solve numerical examples and verify the results experimentally.
2. Write a MATLAB/ SCILAB Programs to do analysis of signals and systems.
3. Use in-built MATLAB/ SCILAB functions for signals and system analysis.

Course Content

Module No.	*Details*	*Hrs.*
1	Signal plotting and manipulation	02
2	Effect of sampling	02
3	Convolution	02
4	Analysis of a DT system (solving difference equation)	02
5	Construction of CT time signal using Fourier Series	02
6	Analysis of a CT system using Laplace Transform	02
7	Laplace Transform and Z- Transform (using symbolic Math)	02
8	Analysis of a DT system (using ZT), draw pole – zero plot	02
9	Modelling of a given physical system	02
10	Frequency response of a system	02

List of Class Assignments

1	Signal plotting, manipulation and classification
2	System classification and convolution
3	DT system analysis in time domain
4	CT Fourier Series, Fourier Transform and system analysis
5	Laplace Transform and system analysis
6	Z Transform and system analysis
7	Realization of system

Reference Books

1. Alan V. Oppenheim, Alan V. Willsky and S.Hamid Nawab, “Signals and Systems”, Prentice-Hall
2. Mrinal Mandal and Amir Asif, “Continous and Discrete Time Signals and Systems”, Cambrige International Student Edition, Tata McGraw-Hill.
3. Haykin S and Van Veen B., “Signal & Systems”, Wiley Publication, 2nd Ed.,2002.
4. Hwei P. Hsu, SCHAUM'S OUTLINES OF “Theory and Problems of Signals and Systems”, McGraw-Hill International.

Indian Traditional Knowledge

Course Code	Course Name
MC-BTE002	Indian Traditional Knowledge

Course pre-requisites	Higher Secondary Education

Course Objectives

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course provides an introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system. The course also provides offers an overview of Indian philosophical traditions, Indian linguistic Tradition, and Indian artistic tradition.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Explain basics of Indian tradition and Indian traditional knowledge systems.
2. Describe basics of Indian traditional health care, technologies and its scientific perspectives.
3. Explain basics of Indian artistic, linguistic and philosophical tradition.
4. Co-relate the Indian traditional knowledge in modern scientific perspective

Course Content

Module No.	*Details*	*Hrs.*
1	**Indian Tradition:** Fundamental unity of India, India‟s heroic role in world civilization, The Indian way of life, Introduction to Indian tradition, The Scientific Outlook and Human Values.	04
2	**Basic structure of Indian Knowledge System:** Indian Traditional Scriptures, Exposure to 4-Vedas, 4-Upvedas (Ayurveda, Dhanurveda, Gandharvaveda, Sthapatya etc.), 6-Vedangas (Shiksha, Kalp, Nirukta, Vyakaran, Jyotish), 6-Upangas (Dharmashastra, Meemansa, Puranas, Tarkashastra/Logic) etc.	06
3	**Indian Knowledge System and Modern Science:** Relevance of Science and Spirituality, Science and Technology in Ancient India, Superior intelligence of Indian sages and scientists.	04
4	**Indian Traditional Health Care:** Importance and Practice of Yoga, Pranayam and other prevailing health care techniques.	04
5	**Indian Artistic Tradition:** Introduction and overview of	04

	significant art forms in ancient India such as painting, sculpture, Civil Engineering, Architecture, Music, Dance, Literature etc.	
6	**Indian Linguistic Tradition:** Ancient Indian languages and literary Heritages, Phonology, Morphology, Syntax and Semantics.	03
7	**Indian Philosophical Tradition:** (Sarvadarshan)- Nyay, Viaishepik, Sankhya, Yoga, Meemansa, Brief understanding of Philosophy of Charvaka, Bhagwan Mahaveer Jain, Bhagwan Buddha, Kabeer, Guru Nanak Dev and other eminent	03

Term Activities

The Term Activities will consist of one assignment on each module, group discussions, presentations, case study on various topics based on above curriculum. Required attendances, involvement in academic activities related to course and overall conduct carry weightage.

Text Books

1. Ajwani L.H., *Immortal India*, Vora & Co. Publishers, 1997.
2. Swami Jitatmananda, *Modern Physics and Vedanta*, Bharatiya Vidya Bhavan, 2004.
3. Krishnamurthy, V. *Science and Spirituality- A Vedanta Perception,* Bharatiya Vidya Bhavan, 2002.
4. Sharma D.S., The Upanishadas- An Anthology, Bharatiya Vidya Bhavan, 1989.
5. Raman V.V., *Glimpses of Indian Heritage,* Popular Prakashan,1993.

Reference Books

1. Sivaramakrishnan, V., *Cultural Heritage of India- Course Material*, Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014.
2. Capra F., Tao of Physics, Shambhala, 2010.
3. Chaterjee S.C. and Datta D.M., *An Introduction to Indian Philosophy,* University of Calcutta, 1984.
4. Krishna Chaitanya, *Arts of India*, Abhinav Publications, 1987.
5. Jha V.N., *Language, Thought and Reality*

Sr. No.	Examination	Module
1	T-I	1,2
2	T-II	3,4
3	End Sem	1 to 7

Appendix –I
Value Added Courses

1. **Soft Computing I (VA-BTE001)**

   Course Objective: Provide knowledge of MATLAB/ SCILAB.

   Course Outcome: Students will be able to develop applications using MATLAB/ SCILAB

   Course content: 1. Basic Introduction and Overview, 2. Variables and Data types, 3. Operation, Control Structure 4. Functions 5.Introduction to different tool boxes available 6. Introduction to MATLAB simulink

2. **Semiconductor Devices and PCB design (VA-BTE002)**

3. **Open source operating systems and Software (Linux, python/ SciLab/octave/ R (VA-BTE003)**

4. **Electrical and Electronics Simulation Lab (VA-BTE004)**