VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For

Second Year Undergraduate Programme Leading to

Bachelor of Technology (B. Tech.) Degree

in

Electronics Engineering

Implemented from the batch admitted in Academic Year 2018-19

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(Autonomous Institute affiliated to University of Mumbai)

Curriculum

(Scheme of Instruction & Evaluation and Course contents)

For

Second Year Undergraduate Programme Leading to
Bachelor of Technology (B. Tech.)
In

106 Electronics Engineering

Institute Vision

To establish global leadership in the field of Technology and develop competent human resources for providing service to society

Institute Mision

- **To provide students with comprehensive knowledge of principles of engineering with a multi-disciplinary approach that is challenging**
- **To create an intellectually stimulating environment for research, scholarship, creativity, innovation and professional activity.**
- **To foster relationship with other leading institutes of learning and research, alumni and industries in order to contribute to National and International development.**

Department Vision

To establish global leadership in the field of Electrical, Electronics & Communication Engineering and to develop competent human resources for providing service to society.

Department Mission

- **To provide student with comprehensive knowledge for taking up challenges in the field of Electrical Engineering with a multi-disciplinary approach.**
- **To create an intellectually stimulating environment for research, industry interaction, creativity, innovation and professional activity.**
- **To foster relationship with renowned institutes of learning and research, alumni and industries in order to contribute to National and International development.**

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Electronics Engineering Graduates will have ability to

• Apply analysis, design, optimization and implementation skills in order to formulate and solve Electronics Engineering and multidisciplinary problems.

• Take up higher studies, innovation, research & development and other such creative efforts in technology.

• Use their skills in professional manner to raise the satisfaction level of stake holders.

PROGRAM OUTCOMES (POs)

Engineering Graduate will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Electronics Engineering Graduate will be able to:

1. Design, develop and test electronic systems in the areas related to analog and digital electronics, electronic instrumentation, signal processing and VLSI design.
2. Analyze, design and implement electronic systems to strive balance between increasing complexity, robustness and performance of systems.
3. Design electronic software and hardware systems, components or process to meet desired needs within realistic constraints.

B.Tech. (Electronics Engineering)
Scheme of Instruction and Evaluation

S Y B. Tech (Electronics Engineering), SEMESTER III								
Scheme of Instruction				Scheme of Evaluation				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**MST**	**ESE**	**ESE hours**
1.	R4MA2003S	Mathematics for Electrical Engineers - I	3-0-0=3	3	20	20	60	3
2.	R4EC2001S	Electrical Networks	3-0-0=3	3	20	20	60	3
3.	R4EC2002T	Electronics Circuit Analysis and Design - I	3-0-0=3	3	20	20	60	3
	R4EC2002P	Electronics Circuit Analysis and Design - I Lab	0-0-2=2	1	60	-	40	2
4.	R4EC2003T	Digital Combinational Circuits	3-0-0=3	3	20	20	60	3
	R4EC2003P	Digital Combinational Circuits Lab	0-0-2=2	1	60	-	40	2
5.	R4EC2004S	Numerical Techniques	2-0-0=2	2	20	20	60	3
6.	R4EC2005T	Python Programming	3-0-0=3	3	20	20	60	3
	R4EC2005P	Python Programming Lab	0-0-2=2	1	60	-	40	2
7.		Environmental Studies	1-0-1=2	MNC	60	-	40	2
		Total	25	20				

S Y B. Tech (Electronics Engineering), SEMESTER IV								
Scheme of Instruction				Scheme of Evaluation				
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/week)**	**Credits**	**TA**	**MST**	**ESE**	**ESE hours**
1.	R4MA2013S	Mathematics for Electrical Engineers – II	3-0-0=3	3	20	20	60	3
2.	R4EC2011S	Signals and Systems	3-0-0=3	3	20	20	60	3
3.	R4EC2012T	Digital Sequential Circuits	3-0-0=3	3	20	20	60	3
	R4EC2012P	Digital Sequential Circuits Lab	0-0-2=2	1	60	-	40	2
4.	R4EC2013T	Electronics Circuits Analysis and Design - II	3-0-0=3	3	20	20	60	3
	R4EC2013P	Electronics Circuits Analysis and Design - II Lab	0-0-2=2	1	60	-	40	2
5.	R4EC2014T	Measurements and Instrumentation	2-0-0=2	2	20	20	60	3
	R4EC2014P	Measurements and Instrumentation Lab	0-0-2=2	1	60	-	40	2
6.	R4EC2015T	Microprocessor and Microcontroller	3-0-0=3	3	20	20	60	3
	R4EC2015P	Microprocessor and Microcontroller Lab	0-0-2=2	1	60	-	40	2
7.	R4EC2016A R4EC2017A	Liberal arts (Any one course) i) Appreciation of Music ii) Dramatics	1-0-2=3	MNC	60	-	40	2
		Total	28	**21**				

Programme Name	B. Tech. (Electronics Engineering), SEMESTER - III
Course Code	R4MA2003S
Course Title	MATHEMATICS FOR ELECTRICAL ENGINEERS – I

COURSE OUTCOMES

After completion of this course, students should be able to

- Compute and characterise behaviour of complex variables
- Compute the Laplace transform of various functions
- Analyse and solve differential equation using Laplace transforms
- Evaluate the Fourier components of various functions

COURSE CONTENTS

Module I	Complex Variables I
	1.1 Function of Complex variable. Analytic function, Necessary and sufficient conditions for f(Z) to be analytic. Cauchy-Riemann equations in polar coordinates. 1.2 Milne-Thomson method to determine analytic function f(Z) when its real or imaginary part or its combination is given. 1.3 Harmonic function, orthogonal trajectories. Transformations 1.4 Conformal mapping and standard transformations such as Rotation, Magnification and inversion. 1.5 Bilinear Transformation and Mapping under bilinear Transformation with geometrical interpretation. Cross ratio and fixed points.
Module II	**Complex Variables II**
	2.1 Line integral of a function of Complex variable, Properties of line integral Cauchy's theorem for analytic function. Cauchy's Goursat theorem (without proof), Cauchy's integral formula and deductions. 2.2 Series of Complex Term: Taylor's and Laurent's Series (without proof), Singularities and poles, Residues, Residue Theorem and its evaluation. 2.3 Application of Residue to evaluate real Function.
Module III	**Laplace Transforms I**
	3.1 Functions of bounded variation 3.2 Linear property of Laplace transforms. 3.3 Laplace transforms of standard functions such as; *1, t^n, e^{at}, sinat, cosat, sinhat, erf(t)* 3.4 Change of scale property ,First shifting theorem, Second shifting theorem $L\{t^n f(t)\}, L\{f'(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n}{dt^n} f(t)\right\}$
Module IV	**Laplace Transform II**
	4.1 Inverse Laplace transform using linear property, theorems, partial fractions and convolution theorem.

	4.2 Unit step functions, Heaviside, Dirac delta functions, Periodic functions and their Laplace transforms. 4.3 Application to solve ordinary differential equations with one dependent variable.
Module V	**Fourier Series**
	Orthogonal, Orthonormal sets, Expressions of a Function in Series of Orthogonal Functions. 1.2. Dirchlet's conditions. 1.3. Fourier series of periodic function with period 2π, $2l$. 1.4. Dirchlet's theorem, even and odd functions. 1.5. Half range expansions, Parseval's relations. 1.6. Complex form of Fourier series. 1.7. Fourier integral and Fourier transform.
Text Books:	
1.	Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd, 10^{th} edition, 2015
2.	Complex Variables & Applications: James Brown and Ruel Churchill, McGraw Hill, 8^{th} Edition, 2017.
Reference Books:	
1.	T Veerrajan ,Engineering Mathematics, McGraw Hill India, 2002
2.	B S Grewal, Higher Engineering Mathematics, Khanna Publications, 39th Edition, 2005
3.	Jain & Iyengar, Advanced Engineering Mathematics, Narosa Publication, 2^{nd} Edition

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - III**
Course Code	**R4EC2001S**
Course Title	**ELECTRICAL NETWORKS**

COURSE OUTCOMES

After completion of this course, students should be able to

- Analyse electrical networks using various Theorems.
- Characterise a network in terms of frequency and time domain parameters.
- Represent a network in terms of its two port network parameters.
- Obtain the frequency domain representations using Fourier analysis

COURSE CONTENTS

Module I	**Review**
	DC and AC circuits.
Module II	**Mesh and Node Analysis**
	Mesh and Node Analysis of circuits with independent and dependent sources.
Module III	**Linearity, Superposition and Source Transformation**
	Linearity, Superposition, Current AND Voltage Source Transformation
Module IV	**Network Theorems**
	Thevenin's and Norton's Theorem (with independent and dependent sources), Maximum power transfer theorem.
Module V	**Circuit Analysis**
	Introduction to Graph Theory. Tree, link currents, branch voltages, cut set and tie set. Mesh and Node Analysis, Gauss Elimination Technique, Duality.
Module VI	**Time and Frequency Response of Circuits**
	First and second Order Differential equations, initial conditions. Evaluation and analysis of Transient and Steady state responses using Classical Technique as well as by Laplace Transform (for simple circuits only). Transfer function, Concept of poles and zeros. Frequency response of a system (concepts only).
Module VII	**Two - port Networks**
	Concept of two- port network. Driving point and Transfer Functions, Open Circuit impedance (Z) parameters, Short Circuit admittance (Y) parameters, Transmission (ABCD) parameters. Inverse Transmission (A'B'C'D') parameters. Hybrid (h) parameters. Inter Relationships of different parameters. Interconnections of two - port networks. T and Pi representation. Terminated two - port networks.
Module VIII	**Fourier Series Application in Network Analysis**

	Orthogonal basis functions, Representation of a signal in terms of weighted Orthogonal basis functions, Calculation of weights (coefficients) in MSE sense, Extension to periodic signal in terms of Fourier Series Representation. Complex and Trigonometric Fourier series, Properties of Fourier series, Power Spectral Density, Circuit Analysis using Fourier Series
Text Books:	
1.	A Sudhakar and S P Shyammohan, Circuits and Networks, Tata McGraw Hill, thirteenth reprint, 2000.
2.	William H Hayt, Jack E Kemmerly and Steven M Durbin, Engineering Circuit Analysis, McGraw Hill International, sixth edition, 2002.
Reference Books:	
1.	Artice M Davis, Linear Circuit Analysis, Thomson Asia Pvt. Ltd., Singapore, first edition, 2001
2.	M. E. Van Valkenburg, Network Analysis, Prentice Hall of India, third edition. 2006
3.	Raymond A DeCarlo and Pen-Min Lin, Linear Circuit Analysis, Oxford University Press, second edition, 2001.

Programme Name	B. Tech. (Electronics Engineering), SEMESTER - III
Course Code	R4EC2002T
Course Title	ELECTRONIC CIRCUITS ANALYSIS AND DESIGN - I

COURSE OUTCOMES

After completion of this course, students should be able to

- Describe qualitatively the behaviour and characteristics of various semiconductor devices and circuits.
- Analyse BJT and FET transistor circuits for their DC and AC characteristics.
- Compare and characterise different amplifier circuits.
- Design small signal amplifier circuits using BJT and FET.

COURSE CONTENTS

Module I	**Semiconductor Materials and Diodes**
	Review of Semiconductor Materials and Properties, The PN Junction, Introduction to Semiconductor Diode Theory. Diode Circuits: DC Analysis and Models, AC Equivalent Circuits, Other Diode Types – Solar Cell, Photodiode, Light–Emitting Diode, Schottky Barrier Diode, Zener Diode, Temperature Effects, Understanding Manufacturer's Specifications
Module II	**Diode Circuits**
	Design of Rectifier Circuits, Half Wave Rectification, Full Wave Rectification, Filter, Ripple Voltage and Diode Current, Voltage Doubler Circuit, Zener Diode Circuits, Clipper and Clamper Circuits, Multiple–Diode Circuits, Photodiode and LED Circuits.
Module III	**Bipolar Junction Transistor**
	Basic Bipolar Junction Transistor, Transistor Structures, NPN Transistor: Forward–active Mode Operation, PNP Transistor : Forward–active Mode Operation, Circuit Symbols and Conventions, Current–Voltage Characteristics, Non ideal Transistor Leakage Currents and Breakdown, DC Analysis of Transistor Circuits, Common–Emitter Circuits, Load Line and Modes Of Operation, Common Bipolar Circuits: DC Analysis, Basic Transistor Applications – Switch, Amplifier, Bipolar Transistor Biasing – Single Base Resistor Biasing, Voltage Divider Biasing and Bias Stability, Integrated Circuit Biasing, Multistage Circuits.
Module IV	**Basic BJT Amplifiers**
	Analog Signals and Linear Amplifiers, The Bipolar Linear Amplifier, Graphical Analysis and AC Equivalent Circuit, Small Signal Hybrid – □ Equivalent Circuit of the Bipolar Transistor, Hybrid – □ Equivalent Circuit Including the Early Effect, Expanded Hybrid – □ Equivalent Circuit, Other Small – Signal Parameters And Equivalent Circuits, Basic Transistor Amplifier Configurations, Common Emitter Amplifiers, AC Load Line Analysis, Common Collector Emitter Follower Amplifier, Common Base Amplifier, The Three Basic Amplifier configurations: Summary and Comparison, Multistage Amplifiers, Power Considerations,

	Environmental Thermal Considerations in Transistor Amplifiers, Manufacturers' Specifications.
Module V	**Field Effect Transistor**
	Junction Field–Effect Transistor, MOS Field–Effect Transistor, MOSFET DC Circuit Analysis, Basic MOSFET Applications: Switch, Digital Logic Gate and Amplifier. Temperature effects in MOSFETs, Input Protection in MOSFET. Power FET (VMOS).
Module VI	**Basic FET Amplifiers**
	The MOSFET Amplifier, Basic Transistor Amplifier Configurations, Common Source Amplifier, Source Follower Amplifier, Common Gate Configuration, Three Basic Amplifier Configuration: Summary and Configuration, Single – Stage Integrated Circuit MOSFET Amplifiers, Multistage Amplifiers, Basic JFET Amplifiers
Text Books:	
1.	Donald A. Neamen, Electronic Circuit Analysis and Design, Second edition, McGraw Hill International edition, 2006
2.	Martin Roden , Gordon Carpenter, William Wieserman, Electronic Design, Fourth edition, Shroff Publishers, 2002
Reference Book:	
1.	David Bell, Electronic Devices and Circuits, Oxford University Press, 5th Edition, 2008
2.	Donald Schilling & Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International edition, 1989

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – III**
Course Code	**R4EC2002P**
Course Title	**ELECTRONIC CIRCUITS ANALYSIS AND DESIGN – I LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Design and implement electronic circuits to meet desired specifications.
- Analyse and design wave shaping circuits, multistage amplifiers, and power amplifiers.
- Explain basic analog electronic circuit design techniques using diodes, bipolar junction transistors and field effect transistors.

LIST OF EXPERIMENTS

Sr.	Experiments
1	Forward and reverse characteristics of PN junction diode.
2	Forward and reverse characteristics of Zener diode.
3	Zener diode as voltage regulator.
4	Static and dynamic characteristics of BJT
5	BJT bias circuits – Design, assemble and test.
6	JFET bias circuits – Design, assemble and test.
7	Design, assemble and test of BJT common-emitter circuit – D.C and A.C performance: Voltage gain, input impedance and output impedance with bypassed and un-bypassed emitter resistor.
8	Design, assemble and test of BJT emitter-follower – D.C and A.C performance: A.C. voltage gain, input impedance and output impedance.
9	Design, assemble and Test of JFET/MOSFET common-source and common-drain amplifiers – D.C and A.C performance: Voltage gain, input impedance and output impedance.
10	Frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response.

Programme Name	B. Tech. (Electronics Engineering), SEMESTER - III
Course Code	R4EC2003T
Course Title	DIGITAL COMBINATIONAL CIRCUITS

COURSE OUTCOMES

After completion of this course, students should be able to

- Represent data in various number systems and perform inter conversions.
- Analyse the behaviour of various logic circuits and logic families.
- Design various combinational circuits as per different specifications.
- Numerically analyse various logic circuits and perform Boolean reduction
- Design Parity circuits, Comparators, Adders, Subtractors, ALUs

COURSE CONTENTS

Module I	**Introduction**
	Analog vs Digital systems, digital devices, integrated circuits, programmable logic devices, digital design levels, software aspects of digital design
Module II	**Number System**
	Positional number systems, Binary and Hexadecimal number systems, general positional number systems conversions, arithmetic operations, representation of negative numbers, arithmetic operations on signed numbers, binary and gray codes, character codes, codes for detecting and correcting errors.
Module III	**Logic Circuits**
	Logic signals and gates, Boolean Algebra, theorems, combinational circuit analysis, combinational circuit synthesis – minimization, Karnaugh Maps, sum of products and product of sums expressions and their minimization, programmed minimization methods – Quine-Mc-Cluskey minimization algorithm, timing hazards – static and dynamic hazards, introduction to VHDL hardware description language.
Module IV	**Logic Families**
	CMOS logic; MOS transistors, basic CMOS inverter circuit, CMOS NAND and NOR gates, fan – in, fan – out, Electrical behavior of CMOS circuits, propagation delay, power consumption, CMOS logic families, bipolar logic introduction, BJT, TTL NAND and NOR gates, fan – in, fan – out, Electrical behavior of TTL circuits, propagation delay, power consumption. CMOS / TTL interfacing, Introduction to Emitter – coupled logic.
Module V	**Combinational Logic Design**
	Introduction to Combinational and Sequential Circuits: Introduction to combinational circuit: Realization of basic combinational functions like comparison, code conversion, decoding, multiplexing, de-multiplexing, addition, subtraction. Delays and hazards in combinational circuits.

Module VI	**Combinational Logic Modules and their applications**
	Decoders, encoders, multiplexers, de-multiplexers and their applications; Parity circuits and comparators; Arithmetic modules- adders, subtractors and ALU; Design examples
Text Books:	
1.	John F. Wakerley, Digital Design Principles and Practices, fourth edition, Pearson Education India, 2008.
2.	Stephen Brown & ZvonkoVranesic, Fundamentals of Digital logic with VHDL design, third edition, McGraw Hill edition, 2014.
Reference Books:	
1.	Moris & Miller (Eds), Designing with TTL Integrated Circuits: Prepared by Staff of Texas Instruments, McGraw Hill International edition, 1981
2.	G K Kharate , Digital Electronics, Oxford University Press 2015

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - III**
Course Code	**R4EC2003P**
Course Title	**DIGITAL COMBINATIONAL CIRCUITS LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Design and implement combinational circuits using gates.
- Design combinational circuits using ICs
- Implement simple combinational circuits in VHDL

LIST OF EXPERIMENTS

Sr	Experiments
1	Realization of Logic Gates using discrete components and ICs.
2	Design of combinational logic circuits (Half Adder, Full Adder, Half Subtractor, Full Subtractor) using fundamental and Universal Logic gates
3	Design of Multiplexer, De-multiplexer
4	Design of Encoder and Decoder circuits
5	Design of Code Converters
6	Implementing 8 bit ALU
7	VHDL for Combinational logic.
8	Study of various parameters of logical families and comparative study of TTL and CMOS.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – III**
Course Code	**R4EC2004S**
Course Title	**NUMERICAL TECHNIQUES**

COURSE OUTCOMES

After completion of this course, students should be able to

- Perform an error analysis for a given numerical method.
- Solve linear algebraic equations
- Solve numerical on curve fitting problems
- Perform numerical integration and differentiation

Course Contents

Module I	**Errors in Numerical Computation**
	Error types, analysis and estimation. Error propagation.
Module II	Systems of Linear Algebraic Equations
	Bracketing Methods – The Bisection method, The False position method. Open Methods – The Newton-Raphson method, The Secant method. Gauss-Elimination method – Technique, pitfalls, improvement. Gauss-Jordan method. LU decomposition and matrix inversion. Gauss-Seidel method. (all the methods with relevant engineering applications)
Module III	**Curve Fitting**
	Interpolation – Newton's divided difference, Lagrange Interpolating polynomials. Approximation - Least square approximation technique, linear regression, and polynomial regression. (relevant engineering applications)
Module IV	**Numerical Differentiation and Integration**
	Methods based on interpolation and finite differences. (relevant engineering applications) The Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.
Text Books:	
1.	Seven C Chopra, Raymond C Canale, Numerical Methods for engineers, fourth edition, Tata McGraw Hill, 2002
2.	Robert J Schillig, Sandra L Harris, Applied numerical Methods for Engineers First Edition Thomson AsiaPvt. Ltd., 2002

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – III**
Course Code	**R4EC2005T**
Course Title	**Python Programming**

COURSE OUTCOMES

After completion of this course, students should be able to

- Explain basics concepts of Python programming
- Explain object oriented programming in Python
- Explain the different data structures and select appropriate data structure for the given application

COURSE CONTENTS

Module I	**Introduction to Python**
	Features, Byte code, execution, Python Virtual Machine, frozen binaries memory management, C vs Python,
Module II	**Data types and operators in Python**
	Comments, Docstrings, built-in-data types, sequences, sets, literals, user-defined data types , basic operators, membership operators, operator precedence and associativity, Output, input statements, command line statements, control statements
Module III	**Arrays, Strings and Functions**
	Arrays, importing, indexing, slicing, processing, mathematical operations on Arrays, strings, operations on strings, defining and calling Functions, formal and actual arguments, function decorators, generators
Module IV	**Classes and Objects**
	Class creation, constructor, inheritance: single and multiple , super class constructors and methods, polymorphism, duck typing, operator overloading, overriding, abstract classes and interfaces
Module V	**Data structures in Python**
	Linked list (single, double) , stacks, queues, dequeues, The Stack as an ADT, Stack operations, Array representation of Stack, Link representation of Stack, The Queue as an ADT, Queue operation, Array representation of Queue, Linked representation of Queue
Text Books:	
1.	Core Python Programming, 2nd Edition, Nageswara Rao, Dreamtech Press. New Delhi, 2018.
2.	E Balagurusamy, Introduction to computing and problem solving using python, McGraw Hill Education.
Reference Book:	
1.	Martin Brown, Python, The complete Reference, Indian Edition, Tata McGraw Hill, ISBN: 9789387572942, 9387572943.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – III**
Course Code	**R4EC2005P**
Course Title	**Python Programming LAB**

After completion of this course, students should be able to

- Write programs to implement classical numerical methods solving engineering problems in Python
- Implement object oriented programming in Python
- Implement different data structures and select appropriate data structure for the given application

LIST OF TOPICS

Sr.	Topics
1	Design a simulation in Python which shows how the bisection, and Newton-Raphson methods works for finding roots of an equation f(x) =0
2	Design a simulation in Python to illustrate the Newton-Raphson method of finding roots of an equation f(x) =0
3	Design a simulation to illustrate the convergence of the Secant, Gauss-Seidal method of finding roots of an equation f(x) =0
4	To simulate and determine polynomial using method of Least Square Curve Fitting
5	Creating functions, classes and objects using python. Demonstrate exception handling and inheritance
6	To implement operator overloading, overriding
7	To implement link list, stack, queues
8	To perform operations on abstract data types

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – III**
Course Code	
Course Title	**ENVIRONMENTAL STUDIES**

COURSE OUTCOMES

After completion of this course, students should be able to

- Imply the basic knowledge of environmental protection, sustainable development and improvement.
- Categorize and scrutinize impact of human development on natural resources. Provide the student with an understanding of radioactive waste.
- Interpret the impact of environmental problems on socio economic growth and human health.
- Imply various strategies, technological improvement, and methods for sustainable management of environmental systems and for the remediation of degraded environment.
- Apply different Science and Technology (S&T) based sustainability solutions and limitations as well as to identify impact of human population on the natural environment and human health.

COURSE CONTENTS

Module I	**Significance of Environment Science:**
	Definition, basic principles and scope of environment science. Earth Man and Environment inter-relationship. Need for awareness Industrialization & Urbanization; Modern Human Life, Basic Ecological Concepts Ecosystems, nature of environmental threats Current environmental problems, Importance of clean air.
Module II	**Ecosystems and Its conservation:**
	Introduction, definition: genetic, species and ecosystem diversity. **Concept of an ecosystem**: Structure and function of an ecosystem, Producers, consumers and decomposers. **Conservation of ecosystem**: Natural Resources, Renewable and Non-renewable Resources, Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation of natural resources. Biodiversity and its significance, and conservation. Global, National and effects of biodiversity.
Module III	**Fundamentals of Environmental Chemistry**
	Definition, Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards (h) Radioactive Waste (I) E-waste. Importance of Environmental Chemistry to access and manage environmental pollution.
Module IV	**Pollution Monitoring and Control Methods**
	Methods of controlling air pollution: Pollution controlling methods, Principle, construction, working and application of Equipment for gaseous pollutants control: Method to control water pollution: Principle, construction, working. Concept of Sustainability and Green Chemistry as a tool for sustainable development.
Module V	**Environmental Assessment, Management and Legislation:**

	Aims And Objectives Of Environmental Impact Assessment (EIA). Environmental Impact Statement (EIS) And Environmental Management Plan (EMP) Environmental Ethics: Issues And Possible Solutions: Environment Audit :Principle, Procedure And Benefits Case study can be submit by the students. ***Projects and activities by students on Current Environmental Issues in India*** *Global Environmental Issues:* Biodiversity loss ,Climate change, Ozone layer depletion, Sea level rise Global Warming ***International efforts for environmental protection and contribution of India for same, National Action Plan on Climate Change***
Text Books:	
1.	De., Environmental Chemistry, 6th Edition, New Age International.
2.	P.K.Goel, Water Pollution, Causes, Effects and Control, New Age International
3.	Erach Bharucha, Text Book of Environmental Studies for Undergraduate Courses, Universities Press, Second Edition
4.	Dr. Jagdish Krishnaswamy and Dr. R. J. Ranjit Daniels, Environmental Studies, Wiley India Private Limited, New Delhi, First Edition, 2009.
Reference Books:	
1.	Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad
2.	Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai
3.	Jadhav, H &Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995
4.	Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - IV**
Course Code	R4MA2013S
Course Title	**MATHEMATICS FOR ELECTRICAL ENGINEERS – II**

COURSE OUTCOMES

After completion of this course, students should be able to

- Perform operations on matrices including transformation and reduce to canonical form.
- Solve problems on vectors using different theorems.
- Understand Bessel function and solve problems on Legendre polynomials.
- Apply properties of Z transform and its inverse to solve engineering problems.
- Explain and solve basic problems of probability and random variables

COURSE CONTENTS

Module I	**Matrices**
	1.1 Eigen values Eigen vectors of square matrix. 1.2 Cayley Hamilton's theorem and function of square matrix. 1.3 Similarity Matrices, Modal Matrix 1.4 Function of Square a Matrix, Minimal Polynomial and Minimal Equation of a Matrix, Derogatory and Non-Derogatory Matrices. 1.5 Quadratic forms : Linear Transformation , Linear Transformation of Quadratic forms , Congruence of a square Matrix 1.6 Reduction to Canonical form under Congruent and Orthogonal Transformation of Quadratic form, rank, index, signature and class value of Quadratic form.
Module II	**Vector Calculus and Analysis**
	2.1 Scalar and vector point functions, Directional derivative, Curl and Divergence, Conservative, Irrotational and Solenoid field. 2.2 Line integral, Green's theorem for plane regions and Properties of Line integral. 2.3 Stoke's theorem, Gauss's divergence theorem (without proof) related identities and deductions.
Module III	**Bessel Functions**
	3.1 Bessel's Equation**,** Solutions of Bessel's function**,** Bessel's Function of Jn(x). 3.2 Recurrence formula Jn(x), Equation Reducible to Bessel's equation 3.3 Orthogonality of Bessel's functions, A Generating function for Jn(x), 3.4 Trigonometric Expansion involving Bessel's functions, 3.5 Bessel's Integral, Legendre's Equation, Legendre's Polynomial, General solution of Legendre's Equation, Rodrigue's Formula, A Generating function of Legendre polynomial, Orthogonality of Legendre polynomial.
Module IV	**Z Transform**
	4.1 Z-Transform, Properties of z-transform, Theorem, change of Scale, Shifting property.

	4.2 Inverse Z-Transform solution of Difference Equation, Multiplication by k, Division by k, Initial value, Final value, Partial sum, Inversion by residue method, Solution of Difference Equation 4.3 Convolution, Convolution property of Casual Sequence, Inverse of Z-transform by Division, By Binomial Expansion and partial fraction,
Module V	**Probability Theory**
	5.1 Review of introduction to probability, concept of random variable, probability density function, cumulative distribution function 5.2 Moments, characteristic functions, Two random variables: Bi-variate distribution, functions of random variables 5.3 Joint moments, Joint Characteristic functions, Conditional distribution
Text Books:	
1.	Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Ltd, 10^{th} edition, 2015
2.	B. V. Ramana, Higher Engineering Mathematics, McGraw Hill India, 1^{st} edition, 2006
Reference Books:	
1.	T. Veerarrajan, Engineering Mathematics, Tata McGraw-Hill, 2^{nd} Edition
2.	Srimanta Pal & Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 1^{st} edition, 2015

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – IV**
Course Code	**R4EC2011S**
Course Title	**SIGNALS AND SYSTEMS**

COURSE OUTCOMES

After completion of this course, students should be able to

- Understand basic concepts of linear systems and how they interact with continuous-time and discrete time signals.
- Analyse CT and DT signals and systems using Laplace and Z-domain descriptions
- Represent and interpret signals in Fourier domain
- Analyse continuous-time and discrete time signals and systems in time domain.

COURSE CONTENTS

Module I	**Introduction to signals & Systems (CT and DT domain)**
	Definition of Signal, Signal classification, Signal manipulations, Periodicity in CT (Continuous Time) & DT(Discrete Time) domain, Concept of a system, System representations & classification, Concept of Impulse Response, Convolution in CT and DT domain
Module II	**Laplace Transforms**
	Definition & properties of Two-sided & one-sided Laplace Transform, Region of Convergence (ROC), System transfer function, Relationship with Fourier Transform & mapping, Zero state & zero input responses
Module III	**Z Transform**
	Definition & properties of Two-sided & one-sided Z Transform, Region of Convergence (ROC), Relationship with Fourier and Laplace Transform , & mapping, Inverse Z Transform
Module IV	**Fourier Series & Fourier Transform (CTFS, CTFT, DTFS & DTFT)**
	Introduction, properties and uses, amplitude & phase spectra, Energy Spectral Density, Power Spectral Density
Module V	**Introduction to CT Systems**
	System Transfer function & Impulse response, Differential Equations
Module VI	**Introduction to DT Systems**
	Difference equation, FIR & IIR systems, System transfer function, System realization: Direct forms, Cascade & parallel forms, Linear and circular Convolution, BIBO stability.
Module VII	**Time Domain Analysis of DT Systems**
	System Transfer function & Impulse response, Difference equation, Solution of a difference equation, zero input & zero state response calculations
Text Books:	
1.	Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, 2nd edition, 2004

2.	B.P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, India, 2nd edition, 2010.
Reference Books:	
1.	Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, Indian Economy edition, 2009.
2.	Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, 2nd edition, 2002

Programme Name	B. Tech. (Electronics Engineering), SEMESTER – IV
Course Code	R4EC2012T
Course Title	Digital Sequential Circuits

COURSE OUTCOMES

After completion of this course, students should be able to

- Classify and analyse different types of sequential circuits.
- Analyse and design flip-flop based digital applications
- Comprehend, analyse and design FSMs
- Implement synchronous sequential circuits in VHDL and describe different VHDL constructs
- Describe architectures of different programmable logic devices such as (FPGA and CPLD) and structure of different types of memories and use them in digital design.

COURSE CONTENTS

Module I	**Introduction**
	Introduction to sequential circuits, Types: synchronous and asynchronous sequential logic circuits, Comparison between sequential and combinational circuits
Module II	**Sequential Logic systems**
	Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines – state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples
Module III	**State machine design approach**
	Design of state machines – state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Designing state machine using ASM charts; Designing state machine using state diagram; Design examples
Module IV	**Sequential logic modules and their applications**
	Multi-bit latches and registers, counters, shift register, application examples.
Module V	**Memory Devices & Programmable Logic Devices**
	Read-only memory, read/write memory – SRAM and DRAM PLAs, PALs and their applications; Sequential PLDs and their applications; State-machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs)
Text Books:	
1.	John F. Wakerley, Digital Design Principles and Practices, fourth edition, Pearson Education India, 2008.
2.	Stephen Brown & Zvonko Vranesic, Fundamentals of Digital logic with

	VHDL design, first edition, McGraw Hill International edition, 2000.
Reference Book	
1.	Moris& Miller (Eds), Designing with TTL Integrated Circuits: Prepared by Staff of Texas Instruments, McGraw Hill International edition, 1981

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – IV**
Course Code	**R4EC2012P**
Course Title	**Digital Sequential Circuits LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Implement digital sequential circuits using ICs.
- Describe digital sequential circuits in hardware description language.
- Program an FPGA, CPLD

LIST OF EXPERIMENTS

Sr	Experiments
1	Truth Table verification of
	RS Flip Flop
	T type Flip Flop.
	D type Flip Flop.
	JK Flip Flop.
2	JK Master Slave Flip Flop. To simplify the given expression and to realize it using Basic gates and Universal gates
3	To realize and study of Shift Register.
	SISO (Serial in Serial out)
	SIPO (Serial in Parallel out)
	PIPO (Parallel in Parallel out)
	PISO (Parallel in Serial out) To design and set up the following circuit using IC 7483.
4	Design and set up a Sequence Generator using IC 7495.
5	To realize and study Ring Counter and Johnson counter.
6	To design and test 3-bit binary asynchronous counter using flip-flop IC 7476 for the given sequence.
7	To design and test 3-bit binary synchronous counter using flip-flop IC 7476 for the given sequence.
8	To design IC 74193 as a up/down counter.
9	To design IC 7490 as a decade counter with BCD count sequence

Programme Name	B. Tech. (Electronics Engineering), SEMESTER – IV
Course Code	R4EC2013T
Course Title	ELECTRONIC CIRCUITS ANALYSIS AND DESIGN – II

COURSE OUTCOMES

After completion of this course, students should be able to

- Compute and characterise the frequency response of BJT and FET
- Design and analyse various types of power amplifiers
- Design and analyse various types of differential and multistage amplifiers
- Design and analyse various types of feedback amplifiers

COURSE CONTENTS

Module I	**Frequency Response of Amplifiers**
	Amplifier Frequency Response, System Transfer Functions, S – Domain Analysis, First – Order Functions, Bode Plots, Short–Circuit and Open–Circuit Time Constants, Frequency Response: Transistor Amplifiers with Circuit Capacitors, Frequency Response: Bipolar Transistor, Frequency Response: The FET, High Frequency Response of Transistor Circuits.
Module II	**Output Stage and Power Amplifiers**
	Power Amplifiers, Power Transistors – Power BJTs, Power MOSFETs, Heat Sinks, design of heat sinks, Classes Of Amplifiers – Class–A Operation, Class–B Operation, Class–AB Operation, Class–C Operation, Class–A Power Amplifiers, Class–AB Push Pull Complementary Output Stages.
Module III	**Differential and Multistage Amplifiers**
	The Differential Amplifier, Basic BJT Differential Pair, Basic FET Differential Pair, Differential Amplifier with Active Load, BICMOS Circuits, Gain Stage and Simple Output Stage, Simplified BJT Operational Amplifier Circuit, Differential Amplifier Frequency Response. The Darlington Amplifier and Cascade Amplifier.
Module IV	**Feedback and Stability**
	Introduction to Feed Back, Basic Feedback Concepts, Ideal Close–Loop Gain, Gain Sensitivity Bandwidth Extension, Noise Sensitivity, Reduction of Nonlinear Distortion, Ideal Feedback Topologies, Series–Shunt, Shunt–Series, Series–Series, Shunt–Shunt Configurations, Loop Gain, Stability of The Feedback Circuit, The Stability Problem, Bode Plots: One – Pole, Two – Pole, and Three – Pole Amplifiers, Nyquist Stability Criterion, Phase and Gain Margins, Frequency Compensation Basic Theory, Closed Loop Frequency Response, Miller Compensation.
Text Books:	
1.	Donald A. Naeman, Electronic Circuit Analysis and Design, Second Edition, McGraw Hill International Edition 2001.
2.	Martin Roden, Gordon Carpenter, William Wieserman, Electronic Design, Fourth edition, Shroff Publishers,2002.
Reference Books :	
1.	Donald Schilling and Charles Belove, Electronic Circuits Discrete and Integrated, Third edition, McGraw Hill International Edition, 1989
2.	Adel Sedra and, Kenneth Smith, Microelectronic Circuits, Fourth edition, Oxford University Press, 1998.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – IV**
Course Code	**R4EC2013P**
Course Title	**ELECTRONIC CIRCUITS ANALYSIS AND DESIGN – II LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Differentiate the response of BJT and MOSFET at low frequency and radio frequency
- Design and implement BJT based amplifier circuits utilizing various negative feedback topologies
- Design and implement transistorised RC phase shift and Wien bridge oscillators
- Design and implement RF oscillators (Hartley and Colpitt)

LIST OF EXPERIMENTS

Sr.	Experiments
1	Design of Voltage Shunt Feedback Amplifier.
2	Frequency Response of CE Amplifier with and Without Feedback.
3	Design of Current Shunt Feedback Amplifier.
4	Frequency Response of Two stage RC – Coupled Amplifier.
5	Design of Voltage Shunt Feedback Amplifier.
6	Frequency Response of CE Amplifier with and Without Feedback.
7	Measurement of Parameters of Common Emitter Amplifier.
8	Design of RC Phase Shift Oscillator.
9	Design of Wien Bridge Oscillator.
10	Design of Hartley and Colpitt's Oscillator.

Programme Name	B. Tech. (Electronics Engineering), SEMESTER – IV
Course Code	R4EC2014T
Course Title	MEASUREMENTS AND INSTRUMENTATION

COURSE OUTCOMES

After completion of this course, students should be able to

- Describe the working principle of various test and measurement equipment.
- Explain the working principle of various signal generators and analysers.
- Describe various data acquisition techniques and fiber optic based measurements.

COURSE CONTENTS

Module I	**Basic Measurement Concepts**
	Measurement systems – Static and dynamic characteristics – units and standards of measurements – error :-accuracy and precision, types, statistical analysis – moving coil, moving iron meters – multimeters – Bridge measurements : – Maxwell, Hay, Schering, Anderson and Wien bridge.
Module II	**Basic Electronic Measurements**
	Electronic multimeters – Cathode ray oscilloscopes – block schematic – applications – special oscilloscopes:– delayed time base oscilloscopes, analog and digital storage oscilloscope, sampling oscilloscope – Q meters – Vector meters – RF voltage and power measurements – True RMS meters.
Module III	**Signal Generators And Analysers**
	Function generators – pulse and square wave generators, RF signal generators – Sweep generators – Frequency synthesizer – wave analyzer – Harmonic distortion analyzer – spectrum analyzer :- digital spectrum analyzer, Vector Network Analyzer –Digital L,C,R measurements, Digital RLC meters.
Module IV	**Digital Instruments**
	Comparison of analog and digital techniques – digital voltmeter – multimeters – frequency counters – measurement of frequency and time interval – extension of frequency range – Automation in digital instruments, Automatic polarity indication, automatic ranging, automatic zeroing, fully automatic digital instruments, Computer controlled test systems, Virtual instruments
Module V	**Data Acquisition Systems And Fiber Optic Measurements**
	Elements of a digital data acquisition system – interfacing of transducers – multiplexing – data loggers – computer controlled instrumentation – IEEE 488 bus – fiber optic measurements for power and system loss – optical time domain reflectometer.
Text Books:	
1.	Albert D. Helfrick and William D. Cooper – Modern Electronic

	Instrumentation and Measurement Techniques, Pearson / Prentice Hall of India, 2007.
2.	Ernest O. Doebelin, Measurement Systems- Application and Design, TMH, 2007.
Reference Books:	
1.	Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, Pearson Education, 2003.
2.	Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.
3.	David A. Bell, Electronic Instrumentation and measurements, Prentice Hall of India Pvt Ltd, 2003.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – IV**
Course Code	**R4EC2014P**
Course Title	**MEASUREMENTS AND INSTRUMENTATION LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Understand and use CRO.
- Use signal and function generators
- Understand and explain various transducers and their working

LIST OF EXPERIMENTS

Module I	Two experiments on CRO (Frequency measurement, study of Lissageous patterns)
Module II	Three experiments on signal generators and function generators
Module III	Three experiments on various transducers
Module IV	Study of digital and electronic voltmeter

Programme Name	B. Tech. (Electronics Engineering), SEMESTER – IV
Course Code	R4EC2015T
Course Title	MICROPROCESSOR AND MICROCONTROLLER

COURSE OUTCOME

After completion of this course, students should be able to

- Describe architecture of a typical microprocessor and microcontroller.
- Design a microprocessor system consisting of a microprocessor / microcontroller, memory, I/ O and other relevant devices.
- Design and implement assembly language programs for 8085 / 8051 microprocessor / microcontroller.
- Design and implement I/O data transfer techniques

COURSE CONTENTS

Module I	**Introduction**
	Introduction to Microprocessors, Microcontrollers and Assembly Language.
Module II	**8085 Microprocessor Architecture and Memory Interfacing**
	The 8085 architecture, Instruction cycles, machine cycles and T states. Concept of wait states. Memory interfacing with timing considerations. Clock, Reset and buffering circuits.
Module III	**8085 Assembly Language Programming**
	The 8085 programming model, Instruction classification, Instruction and Data format, process of writing, assembly and execution of simple assembly language programs.
Module IV	**Programming Techniques**
	Data transfer operations, Arithmetic & Logic operations, Branch operations, Writing assembly language programs, Debugging a program. Looping, Counting and indexing, counters and timers, Code conversion, BCD arithmetic and 16 bit data operations. Software Development Systems and Assemblers. Concept of Stack and subroutines, parameter passing techniques, Re-entrant and recursive subroutines.
Module V	**Parallel I/O Data Transfer Techniques**
	Basic interfacing concepts, Interfacing input and output devices with examples, Memory mapped I/O and I/O mapped I/O. I/O data transfer classification, Programmed I/O, Interrupt driven program controlled I/O, Interrupt Requirements, Single level interrupt, Multi-level interrupt, Vectored interrupt. 8085 interrupt structure and operation. 8259A programmable interrupt controller features and operation – single and cascaded. Hardware I/O (Direct Memory Access).
Module VI	**Intel MCS 51 family**

	Introduction to Single chip microcontrollers of Intel MCS 51 family. Architectural and operational features. Instruction set. CPU timing and machine cycles. Interrupt structure and priorities. Internal Timer / counters, serial interface. Interfacing of external memory. Power saving modes.8051 variants. 89C51 devices
Text Books:	
1.	Ramesh S Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Sixth edition, Penram International Publishing (India), 2013.
2.	Kenneth Short, Microprocessors and Programmed Logic, second edition, Prentice Hall of India, 1987.
Reference Books:	
1.	Kenneth Ayala, The 8051 Microcontroller & Embedded Systems Using Assembly and C, Cengage Learning, first edition, 2010
2.	Muhammad A Mazidi, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, second edition, 2008

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER – IV**
Course Code	**R4EC2015P**
Course Title	**MICROPROCESSOR AND MICROCONTROLLER LAB**

COURSE OUTCOMES

After completion of this course, students should be able to

- Understand and use microprocessor circuits and kits.
- Design and implement assembly language programs for 8085 / 8051 microprocessor / microcontroller.
- Design and program parallel data transfer techniques

LIST OF EXPERIMENTS

COURSE CONTENTS

Module I	Two programs on Data transfer operations based on 8085 microprocessor
Module II	Five programs on Arithmetic & Logic operations with increasing complexity based on 8085 microprocessor
Module III	Three programs on sorting based on 8085 microprocessor.
Module IV	Three programs on I/O operations and interrupts based on 8085 microprocessor.
Module V	Three programs on Arithmetic & Logic operations with increasing complexity based on 8051 microcontroller.
Module VI	Two programs on I/O operations and interrupts based on 8051 microcontroller.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - III**
Course Code	**R4EC2016A**
Course Title	**Liberal arts** **i) Appreciation of Music**

COURSE OUTCOMES

After completion of this course, students should be able to

- Describe the origin and development of Indian music.
- Describe the technical terminology for music.
- Identify basic ragas and talas
- Interpret musical performances in context of its technicality

COURSE CONTENTS

Module I	History of Indian Music Brief history of Bharata natyashastra and Sangeetaratnakara
Module II	Classification of Music-vocal and instrumental
Module III	Concept of ragas and talas in Indian music; Classification of ragas; Different gharanas and their history, evolution of notation system.
Module IV	Explanation of technical terms of music. Concert singing/ performing. Music and spirituality.
Module V	Forms of light music, importance of music festivals, place of music in fine arts, music and multi-media,
Text Books:	
1.	Swami Prajnananada, A Historical Study of Indian Music, Munshiram Manoharlal Publishers; Revised, Enlarged edition, Delhi, 1981
2.	Deva, B. Chaitanya, ed. *Introduction to Indian Music*. Publications Division Ministry of Information & Broadcasting, 1992.

Programme Name	**B. Tech. (Electronics Engineering), SEMESTER - III**
Course Code	**R4EC2017A**
Course Title	**Liberal arts** **ii)Dramatics**

COURSE OUTCOMES

After completion of this course, students should be able to

- Describe importance of theatre and theatrical performance.
- Describe history of theatre.
- Enumerate the process of play making.
- compile imagining situations connecting reality.

COURSE CONTENTS

Module I	Why drama: importance of play in general and dramatic play in particular
Module II	Why Theatre: Why did human beings start to do theatre? The triangular relationship between performer, idea and audience -- the art & need of communication
Module III	From Idea to Performance: The process of transforming 'a thought' to a theatrical mode of communication: - WHY create? - Create WHAT? - Create HOW? - Create WHE
Module IV	Imagining Possibilities: - Role Play: to be in somebody else's shoes--the cathartic connection - Imagining Situations - Analysing realities - Imagining alternatives
Module V	The vastness of theatre: A short introduction to the history of theatre - Indian practices & Forms: Traditional & contemporary - Indian theatre in connection with world theatre - Contemporary Indian theatre: As a continuum & how it is practiced today
Module VI	How theatre impacts: The role(s) of theatre. Historical, societal, socio-cultural-political, self-experiential.
Text Books:	
1.	Lajos Egri, The Art Of Dramatic Writing: Its Basis in the Creative Interpretation of Human Motives, Touchstone; Revised edition, February 1972