COURSE STRUCTURE (R20) – ECE

I - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE01	Professional Communication-I	2	0	0	2	30	70	100
2	20FE03	Differential Equations	2	1	0	3	30	70	100
3	20FE07	Applied Physics	2	1	0	3	30	70	100
4	20EE01	Basic Electrical Engineering	3	0	0	3	30	70	100
5	20EC01	Electronic Devices and Circuits	3	0	0	3	30	70	100
Laboratory Courses									
6	20FE51	Professional Communication Skills Lab	0	0	2	1	15	35	50
7	20FE54	Applied Physics Lab	0	0	3	1.5	15	35	50
8	20EE51	Basic Electrical Engineering Lab	0	0	3	1.5	15	35	50
9	20EC51	Electronic Devices and Circuits Lab	0	0	3	1.5	15	35	50
Total			**12**	**2**	**11**	**19.5**	**210**	**490**	**700**

II - SEMESTER

S.No	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE02	Professional Communication-II	2	0	0	2	30	70	100
2	20FE04	Linear Algebra and Transformation Techniques	2	1	0	3	30	70	100
3	20FE06	Engineering Chemistry	3	0	0	3	30	70	100
4	20CS01	Programming for Problem Solving Using C	3	0	0	3	30	70	100
5	20EC02	Digital Logic Circuits	3	0	0	3	30	70	100
6	20MC01	Constitution of India	2	0	0	0	30	70	100
Laboratory Courses									
7	20FE53	Engineering Chemistry Lab	0	0	3	1.5	15	35	50
8	20CS51	Programming for Problem Solving Using C Lab	0	0	3	1.5	15	35	50
9	20EC52	Digital Logic Circuits Lab	0	0	2	1	15	35	50
10	20ME51	Engineering Workshop	0	0	3	1.5	15	35	50
Total			**15**	**1**	**11**	**19.5**	**240**	**560**	**800**

III SEMESTER

S.No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20FE10	Numerical Methods and Integral Calculus	2	1	0	3	30	70	100
2	20CS03	Data Structures	3	0	0	3	30	70	100
3	20EC03	Analog Circuit Design	3	0	0	3	30	70	100
4	20EC04	Signals & Systems	3	0	0	3	30	70	100
5	20EC05	Random Variables & Stochastic Processes	3	0	0	3	30	70	100
Laboratory Courses									
6	20CS53	Data Structures Lab	0	0	3	1.5	15	35	50
7	20EC53	Analog Circuit Design Lab	0	0	2	1	15	35	50
8	20EC54	Digital System Design Lab	1	0	2	2	15	35	50
9	20ECS1	Signal Modeling And Analysis	1	0	2	2	--	50	50
Total			**16**	**1**	**9**	**21.5**	**195**	**505**	**700**

IV SEMESTER

S.No	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	20HS01	Universal Human Values 2: Understanding Harmony	3	0	0	3	30	70	100
2	20EE09	Control Systems	2	1	0	3	30	70	100
3	20EC06	Digital Signal Processing	3	0	0	3	30	70	100
4	20EC07	Analog Communications	3	0	0	3	30	70	100
5	20EC08	Electromagnetic Waves & Transmission Lines	3	0	0	3	30	70	100
6	20MC02	Environmental Science	2	0	0	0	30	70	100
Laboratory Courses									
7	20AD53	Programming Using Python Lab	1	0	2	2	15	35	50
8	20EC55	Digital Signal Processing Lab	0	0	3	1.5	15	35	50
9	20EC56	Analog Communications Lab	0	0	2	1	15	35	50
10	20ECS2	Modeling, Design And Prototyping	1	0	2	2	--	50	50
Total			**18**	**1**	**9**	**21.5**	**225**	**575**	**800**
Honors/Minor Courses						4			

B.Tech. (ISem.) **20FE01 - PROFESSIONAL COMMUNICATION – I**

L	T	P	Cr.
2	0	0	2

Pre-requisites: Nil

Course Educational Objectives: Toimprove English language proficiency of the students on various aspects like vocabulary, grammar, communication skills, listening skills, Reading & Writing skills.

Course Outcomes: At the end of the course, the student will be able to

CO1 : Write sentences and paragraphs using proper grammatical structures and word forms.**(Remember – L1)**
CO2 : Comprehend the given text by employing suitable strategies for skimming and scanning and draw inferences.**(Understand – L2)**
CO3 : Write summaries of reading texts using correct tense forms & appropriate structures.**(Remember – L1)**
CO4 : Write Formal Letters; Memos & E-Mails. **(Apply – L3)**
CO5 : Edit the sentences/short texts by identifying basic errors of grammar/vocabulary/syntax.**(Understand – L2)**

Unit - I
Exploration - 'A Proposal to Girdle the Earth – Nellie Bly'; Reading: Skimming for main idea; Scanning for specific information; Grammar & Vocabulary: Content Words; Function Words; Word Forms: verbs, nouns, adjectives and adverbs; Nouns: Countable and Uncountable, Singular and Plural forms; Wh - Questions; Word Order in Sentences; Writing: Paragraph Analysis; Paragraph Writing; Punctuation and Capital Letters

Unit – II
On Campus- 'The District School as it Was by One Who Went to it – Warren Burton'; Reading: Identifying Sequence of Ideas; Grammar & Vocabulary: Cohesive Devices: Linkers/signposts/Transition signals, Synonyms, Meanings of Words/Phrases in the context; Writing: Memo Drafting.

Unit – III
Working Together-'The Future of Work'
Reading: Making basic inferences; Strategies to use text clues for comprehension; Summarizing; Grammar & Vocabulary: Verbs: Tenses; Reporting Verbs for Academic Purpose; Writing**:** Rephrasing what is read; Avoiding redundancies and repetitions Abstract Writing/ Summarizing.

Unit – IV
'A.P.J.AbdulKalam'; Grammar & Vocabulary: Direct & Indirect Speech; articles and their Omission; Writing: E-Mail Drafting.

Unit – V
'C.V.Raman'; Grammar & Vocabulary: Subject-Verb Agreement; Prepositions; Writing: Formal Letter Writing.

Text Books:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient Black Swan, Hyderabad, 2019.
2. "Panorama – A Course on Reading", A collection of prose selections, Oxford University Press, New Delhi, 2016.

Reference Books:

1. Swan,M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. BaradwajKumkum, "Professional Communication", I.K.International Publishing House Pvt.Lt., New Delhi, 2008.
5. Wood,F.T., "Remedial English Grammar", Macmillan, 2007.

L	T	P	Cr.
2	1	0	3

B.Tech. (I Sem.) **20FE03 - DIFFERENTIAL EQUATIONS**

Pre-requisites: Nil

Course Educational Objective: The objective of this course is to introduce the first order and higher order differential equations, functions of several variables. The students also learn solving of first order partial differential equations.

Course Outcomes: At the end of the course, the student will be able to:

- **CO1**: Apply first order and first-degree differential equations to find orthogonal trajectories. **(Apply – L3)**
- **CO2**: Distinguish between the structure and methodology of solving higher order differential equations with constant coefficients. **(Understand – L2)**
- **CO3**: Apply various Numerical methods to solve initial value problem.**(Apply – L3)**
- **CO4**: Generate the infinite series for continuous functions and investigate the functional dependence.**(Understand – L2)**
- **CO5**: Solve partial differential equations using Lagrange's method.**(Apply – L3)**

UNIT –I
Differential Equations of First Order and First Degree
Differential equations of first order and first degree – Exact and Non Exact differential Equations, Applications of differential equations – Orthogonal Trajectories.

UNIT –II
Linear Differential Equations of Higher Order
Homogeneous and Non-Homogeneous Linear differential equations of second and higher order with constant coefficients with R.H.S. functions e^{ax}, sin $(ax+b)$, cos $(ax+b)$, x^m, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters.

UNIT – III
Numerical solution of Ordinary Differential Equations
Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive approximations.
Euler's Method - Runge- Kutta Methods.

UNIT –IV
Functions of several variables

Generalized Mean Value Theorem (without proof), Maclaurin's series, Functions of several variables, Jacobians (Cartesian and polar coordinates), Functional dependence. Maxima and Minima of function with two variables.

UNIT – V
Partial Differential Equations
Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions. Solution of first order and first degree linear partial differential equation – Lagrange's method.

Text Books:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH Publications, New Delhi, 2010.

Reference Books:

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi,2011.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley & sons, New Delhi,2011.
3. W.E. Boyce and R. C. Diprima, " *Elementary Differential Equations"* , 7th Edition, John Wiley & sons, New Delhi,2011.
4. S. S. Sastry, *"Introductory Methods of Numerical Analysis"* 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

L	T	P	Cr.
2	1	0	3

B.Tech. (I Sem.) **20FE07 - APPLIED PHYSICS**

Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts ofoptics, quantum mechanics, free electron theory of metals, semiconductors, dielectrics and their applications.

Course Outcomes: At the end of the course, the student will be able to,

CO1: Define the nature of interference and diffraction.**(Remember – L1)**
CO2: Apply the lasers and optical fibres in different fields.**(Apply – L3)**
CO3: Estimate the electrical conductivity of metals.**(Understand – L2)**
CO4: Analyze the properties of semiconducting materials.**(Understand – L2)**
CO5: Classify the different types of magnetic and dielectric materials.**(Understand – L2)**

UNIT – I

Wave Optics

Interference**:** Principle of super position, Conditions for Interference, Interference in thin parallel film by reflection, Newton's rings (reflection), working principle of Interferometer.

Diffraction**:** Introduction, Fraunhofer diffraction at single slit- Diffraction due to circular aperture, Diffraction Grating- Resolving power of Grating.

UNIT – II

Lasers and optical fibers

Lasers**:** Introduction - Principle of laser (absorption, spontaneous and stimulated emission of radiation), Einstein Coefficients – Nd-YAG laser, Helium Neon laser- applications.

Optical Fibers: Optical Fiber principle, Structure of optical fiber, numerical aperture and acceptance angle, types of optical fibers - applications.

UNIT – III

Principles of Quantum Mechanics &Free electron theory

Principles of quantum mechanics:de Broglie Hypothesis, Davisson - Germer experiment, Schrodinger time independent and dependent wave equations, physical significance of the wave function – particle in a box.

Free electron theory

Classical free electron theory- Postulates, Advantages and Draw backs, Fermi-Dirac distribution function-Temperature dependence of Fermi- Dirac distribution function, Classification of Solids on the basis of Band theory.

UNIT – IV

Semiconductor physics

Conductivity of Intrinsic and Extrinsic semiconductors,Drift and Diffusion Current, Einstein relation, Hall Effect, Differences between direct and indirect Band Gap semiconductors, Solar Cell, Applications of Solar Cells.

UNIT – V

Magnetic &Dielectricmaterials

Magnetic parameters, Classification of magnetic materials-Diamagnetic, paramagnetic and ferromagnetic materials, Hysteresis loop, soft and hard magnetic materials, Applications of Ferro magnetic materials

Dielectrics: polarization - Electronic and ionic polarization, orientation polarization (Qualitative), Local field, ClaussiusMosotti equation, Applications of dielectric materials.

TEXT BOOKS

1. V. Rajendran, "*Engineering Physics*", TMH, New Delhi, 6th Edition, 2014.
2. M.N. Avadhanulu, P.G. Kshirsagar, "Engineering *Physics*", S. Chand & Co., 2ndEdition, 2014.

REFERENCE BOOKS

1. M.N. Avadhanulu, TVS Arun Murthy, "Applied *Physics*", S. Chand & Co., 2ndEdition, 2007.
2. P.K. PalaniSamy, "*Applied Physics*", Sci. Publ. Chennai, 4th Edition, 2016.
3. P. Sreenivasa Rao, K Muralidhar, "*Applied Physics*", Him. Publi. Mumbai, 1st Edition, 2016.
4. HitendraK Mallik , AK Singh " *Engineering Physics*", TMH, New Delhi, 1st Edition, 2009.

B.Tech. (I Sem.) **20EE01 - BASIC ELECTRICAL ENGINEERING**

L	T	P	Cr.
3	0	0	3

Prerequisite: Physics

COURSE OBJECTIVE: This course deals with nature of basic electrical components, analysis of steady state and transient response of linear electrical networks. It also deals with the principle of operation of AC and DC machines.

Course Outcomes: At the end of the course, students will be able to

CO1: Illustrate the behavior of active and passive components, series and parallel circuits, self and mutual inductance of magnetic circuits, network functions and two port networks using circuit and mathematical approaches.**(Understand – L2)**

CO2: Interpret the working principles of AC and DC machines along with grounding and earthling using electrical engineering fundamentals and mathematical approaches.**(Understand – L2)**

CO3: Apply mesh analysis, nodal analysis and network theorems to solve the Thevinen's voltage, Norton's current and maximum power transfer of the linear circuits. **(Apply – L3)**

CO4: Analyze the concepts of bandwidth, quality factor of series and parallel resonant circuits using circuit and mathematical approaches.**(Analyze – L4)**

UNIT – I:Electrical Circuit Fundamentals

Basic definitions, Types of elements-active and passive, Ohm's Law, Kirchhoff's Laws-Network reduction techniques- series, parallel, star to delta, delta to star transformations, source transformations, mesh analysis, nodal analysis, duality and dual networks.

UNIT – II: MAGNETIC CIRCUITS & AC FUNDAMENTALS

Magnetic Circuits: Self and mutual inductance, dot convention, coefficient of coupling, analysis of series and parallel magnetic circuits, coupled circuits.

AC Fundamentals: Peak, R.M.S, average and instantaneous values, Form factor and Peak factor for periodic waveforms – Phase and Phase difference –Concepts of Reactance, Impedance, Susceptance and Admittance, Real , Reactive and apparent Powers, Power Factor.

UNIT – III: NETWORK THEOREMS & RESONANCE CIRCUITS

Network Theorems (DC Networks): Superposition, Thevenin's, Norton's, Maximum power transfer, reciprocity and Milliman's theorems.

Resonant circuits: Series and parallel resonant circuits, concept of band width, quality factor.

UNIT – IV: NETWORK FUNCTIONS & TWO PORT NETWORKS

Network Functions: Driving point and transfer functions, poles and zeros of network functions, Restrictions of pole and zero locations for driving point and transfer functions.

Two-Port Networks: Z, Y, ABCD & h-parameters, Inter-relationship between parameters, Two port network connections in series, parallel and cascaded.

UNIT – V:ELECTRICAL MACHINES

Electrical Machines: Types of Electrical Machines and their applications; Working principle of DC machines, single phase transformer, 3-phase induction motor; EMF equation.

Electrical Safety: Definition, precautions, concepts of grounding and earthing.

TEXT BOOKS

1. Ravish R Singh, *"Network Analysis and synthesis"*, Tata McGraw Hill Pvt Ltd, New Delhi.2013
2. B.L Theraja, A.K. Theraja, "Electrical Technology in S.I. UNITS. Volume *II.* AC & DC MACHINES" Published by S. Chand & Company Ltd 2016

REFERENCE BOOKS

1. M.S Naidu and S. Kamakshaiah, "Introduction to Electrical Engineering", TMH Publication, 3rd edition 2017.
2. A Sudhakar, Shyammohan S Palli, "Circuits and Networks, Analysis and Synthesis", McGraw Hill Education Pvt. Ltd,7th Edition, New Delhi 2017.

B.Tech. (I Sem.) **20EC01 - ELECTRONIC DEVICES AND CIRCUITS**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Fundamentals of Physics.

Course Educational Objective: This course introduces the Device construction, characteristics and applications of semiconductor devices like PN junction diode, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), Metal oxide Semiconductor Field Effect Transistor (MOSFET) and various special devices.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify the types of Diodes, Transistors, FETs, Biasing techniques and their comparisons to select the best approaches for designing the electronic circuits using Devices and components.**(Apply – L3)**

CO2: Interpret the mathematical models of Currents and Voltages of Diodes, Bipolar Junction Transistors and Field Effect Transistors and biasing of BJT and FET using fundamental circuits.**(Understand – L2)**

CO3: Apply the knowledge of diodes, transistors and filters for designing the rectifiers, Filters, Regulators and Amplifier circuits using Devices and components.**(Apply – L3)**

CO4: Analyze the characteristics of Diodes, Bipolar Junction Transistors, Field Effect Transistors and their equivalent models using VI Characteristics and mathematical models.**(Analyze – L4)**

UNIT – I

PN Junction Diode: Qualitative theory of the p-n Junction; The Current components in a p-n Diode; The Volt- Ampere Characteristic; Diode Capacitance- Transition Capacitance and Diffusion Capacitance. Operation and characteristics of Zener Diode, Tunnel Diode, UJT and SCR.

UNIT – II

Diode Applications: Half wave Rectifier, Full wave Rectifiers, ripple removal using Capacitive. Inductive, and L section Filters. Voltage Regulator using Zener diode, Clippers, and Clampers.

UNIT – III

Bipolar Junction Transistor: BJT-construction and types, different regions of operations; Transistor Current components-Emitter Efficiency, Transport Factor, Large Signal Current Gain; Input and Output characteristics of Transistor configurations; Relation between α , β and γ; Ebers-Moll Model.

UNIT – IV

Field Effect Transistors: Construction and Operation, classification of FET, Comparison between FET and BJT; Drain and Transfer Characteristics of JFET and MOSFET and MOS Capacitor.

UNIT –V

BJT Biasing: Need for biasing; Operating Point, DC load line, AC load line and Stability factors S,S' and S''; Biasing circuits- Fixed bias, Collector to Base Bias and Self Bias; Thermal Runaway and Thermal Stability, Bias Compensation techniques.

FET Biasing: Voltage divider bias, Small signal equivalent of FET.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, Electronic Devices and Circuits, Third edition, Tata McGraw Hill, Publishers, New Delhi.2012

REFERENCE

1. Boylestad R.L. and Louis Nashelsky, Electronic Devices and Circuits, Fourth edition, Pearson/Prentice Hall Publishers,2014.
2. Ben Streetman and Sanjay Banerjee, Solid State Electronic Devices, Fourth edition, Prentice Hall Publishers,2014.
3. Thomas L. Floyd, Electronic Devices, Third edition, Pearson Education Publishers,2014.

B.Tech. (I Sem.)	20FE51 - PROFESSIONAL COMMUNICATION SKILLSLAB	L	T	P	Cr.
		0	0	2	1

Pre-requisites : Nil

Course Educational Objective: To improve the proficiency of students in English with an emphasis on better communication in formal and informal situations;Develop speaking skills required for expressing their knowledge and abilities and to face interviews with confidence.

Course Outcomes: At the end of this course, the student will be able to

CO1: Introduce oneself and others using appropriate language and details.**(Understand–L2)**
CO2: Comprehend short talks and speak clearly on a specific topic using **(Understand – L2)**
CO3: Report effectively after participating in informal discussions ethically**. (Remember-L1)**
CO4: Interpret data aptly, ethically &make oral presentations without. **(Apply – L3)**

Syllabus: Professional Communication Lab (PCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self- study by learners.
- **Interactive Communication Skills (ICS) Lab.** with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo – audio & video system and camcorder etc.

Exercise – I

CALL Lab: Understand - Sentence structure.

ICS Lab: Practice - Listening: Identifying the topic, the context and specific information
Speaking: Introducing oneself and others.

Exercise – II

CALL Lab: Understand - Framing questions.

ICS Lab: Practice - Listening: Answering a series of questions about main idea and supporting ideas after listening to audio text.
Speaking: Discussing in pairs/small groups on specific topics; Delivering short structured talks using suitable cohesive devices (JAM)

Exercise – III

CALL Lab: Understand - Comprehension practice – Strategies for Effective Communication

ICS Lab: Practice - Listening: Listening for global comprehension and summarizing
Speaking: Discussing specific topics in pairs/small groups, reporting what is discussed

Exercise – IV

CALL Lab: Understand- Features of Good Conversation – Strategies for Effective Communication.

ICS Lab: Practice -Listening: making predictions while listening to conversations/transactional dialogues with/without videoSpeaking: Role – plays – formal & informal – asking for and giving information/directions/instructions/suggestions

Exercise – V

CALL Lab: Understand - Features of Good Presentation, Methodology of Group Discussion
ICS Lab:Practice - Introduction to Group Discussions.
Listening: Answering questions identifying key terms and understanding concepts.
Speaking: Formal Oral & Poster presentations on topics from academic contexts without the use of PPT.

Lab Manual:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient Black Swan, Hyderabad, 2019.

Suggested Software:

1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley,USA,2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company,USA,2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi,2008.

B.Tech. (I Sem.)	20FE54 - APPLIED PHYSICS LAB	L	T	P	Cr.
		0	0	3	1.5

Pre-requisites: Nil

Course Educational Objective: This course enables the students to acquire theoretical ideas, analytical techniques, and graphical analysis, by completing a host of experiments with the procedures and observational skills for appropriate use of simple and complex apparatus.

Course Outcomes: At the end of the course, the student will be able to,

Co1: Analyze the wave characteristics of light.**(Understand – L2)**
Co2: Estimate the magnetic field using Stewart's and Gee's apparatus.**(Understand – L2)**
Co3: Verify the characteristics of semiconductor diodes.**(Apply – L3)**
Co4: Determine the acceptance angle and numerical aperture of optical fiber.**(Apply – L3)**
Co5: Improve report writing skills and individual teamwork with ethical values.**(Understand–L2)**

List of Experiments

(Any of the 10 experiments are required to be conducted)

General experiments**:**

1. Determine the energy band gap of a semiconductor Diode.
2. Study the characteristics of Zener Diode.
3. Study the magnetic field along the axis of a current carrying circular coil using Stewart's& Gee's apparatusand to verify Biot - Savart's law.
4. Study the characteristics of Solar cell
5. Determination of dielectric constant by charging and discharging method.
6. Study the characteristics of Photo diode.
7. Determination of resistivity of semiconductor by four probe method.

Optics lab experiments:

8. Determine the wavelength of a laser radiation.
9. Determine the width of a single slit by forming diffraction pattern.
10. Determine the Radius of Curvature of a Plano - Convex lens by forming Newton's Rings.
11. Determine the Wavelengths of various spectral lines by using diffraction grating.
12. Resolving power of grating.
13. Determine the acceptance angle and numerical aperture of a fiber.
14. Measure the bending losses in the optical fiber cable at different wavelengths.

B.Tech. (I Sem.)	20EE51 - BASIC ELECTRICAL ENGINEERING LAB	L	T	P	Cr.
		0	0	3	1.5

Pre-requisites: Nil

COURSE OBJECTIVE: This is a course to expose basic circuit concepts, circuit modeling and methods of circuit analysis in time domain and frequency domain for solving simple circuits including DC and AC circuit theory and network theorems.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Interpret the behavior of passive components of electrical circuits, inductance of magnetic circuits, two port networks and principle of DC machines using fundamental electrical laws and mathematical models.**(Understand – L2)**

CO2: Apply Kirchhoff's laws, Network theorems to verify the linear electrical circuits using fundamental electrical laws and mathematical equations.**(Apply – L3)**

CO3: Examine the active & reactive powers of single phase electrical circuits and resonant frequency, bandwidth & quality factor of electrical circuits.**(Apply – L3)**

CO4: Adapt effective Communication, presentation and report writing skills.**(Apply – L3)**

List of Experiments

(Any of the 10 experiments are required to be conducted)

1. Identify and test passive elements in linear electrical circuits.
2. Determination of closed Loop voltages and node currents using Kirchhoff's laws.
3. Determination of node voltages and branch currents using voltage division and current division rules.
4. Determination of Self inductance, Mutual inductance and Coefficient coupling factor of a Magnetic circuits.
5. Determination of Active and Reactive powers in a Single phase series R-L/R-C circuits.
6. Determination of Resonant frequency, Bandwidth and Quality factor of RLC circuits.
7. Analysis of linear circuit branch response using Superposition theorem.
8. Determination and verification of Voltage & Resistance using Thevenin's theorems, and current & resistance using Norton's theorem.
9. Determination and verification of power transfer using Maximum power transfer theorem.
10. Determination and verification of Z parameters and Y Parameters of two port network.
11. Measurement of efficiency of DC machines using Swinburne's test.
12. Measurement of Torque, Speed and Armature current of DC shunt motor from its characteristics.

B.Tech. (I Sem.)	20EC51 - ELECTRONIC DEVICES AND CIRCUITS LAB	L	T	P	Cr.
		0	0	3	1.5

Pre-requisites: Nil

Course Educational Objective: This course introduces the characteristics and applications of semiconductor devices; emphasis is placed on characteristics and testing practically to strengthen the knowledge.

Course Outcomes: At the end of the course, the student will be able to

CO1: Demonstrate the characteristics of Diodes, BJT, FET, Voltage regulators, Diode applications. **(Understand – L2)**

CO2: Analyze the device parameters of Diodes, Bipolar Junction Transistors, and Field Effect Transistors for its electrical parameters using VI characteristics. **(Analyze – L4)**

CO3: Apply the knowledge of diodes, Capacitors and transistors for the realization of rectifiers, regulators, Clippers and Clampers circuits. **(Apply – L3)**

CO4: Adapt effective Communication, presentation and report writing skills.**(Apply – L3)**

List of Experiments

(Any of the 10 experiments are required to be conducted)

1. Identification of components, Active and Passive Devices, Study and operation of Regulated Power Supplies, CRO and Function generators.
2. Determination of Cut-in Voltage, Forward and Reverse resistances of PN Junction diode using Characteristics.
3. Realization and performance evaluation of Half wave rectifier with and without Capacitor filter.
4. Realization and performance evaluation of Full wave rectifier with and without Capacitor filter.
5. Analysis of Transistor CB Configuration for its Input and Output resistances and Current gains using VI Characteristics.
6. Analysis of Transistor CE Configuration for its Input and Output resistances and Current gains using VI Characteristics.
7. Analysis of Drain and Transfer Characteristics of Field Effect Transistor for its Drain Resistance, Transconductance and Amplification factor.
8. Determination of Breakdown voltage of Zener diode and Design of Zener Voltage regulator.
9. Design and Realization of Series Voltage Clippers with and without bias voltage.
10. Design and Realization of Shunt Voltage Clippers with and without bias voltage.
11. Design and Realization of Voltage Clampers circuits using Diode and capacitors.
12. Realization of Voltage multiplier using Clampers.

B.Tech. (IISem.)	20FE02 - PROFESSIONAL COMMUNICATION – II	L	T	P	Cr.
		2	0	0	2

Pre-requisites: Nil

Course Educational Objective: Toimprove English language proficiency of the students on various aspects like vocabulary, grammar, communication skills, listening skills, Reading & Writing skills.

Course Outcomes: At the end of the course, the student will be able to

- **CO1:** Produce a coherent paragraph interpreting a figure/graph/chart/table. **(Understand – L2)**
- **CO2:** Comprehend the given texts thoroughly by guessing the meanings of the words contextually.**(Understand – L2)**
- **CO3:** Use language appropriately fordescribing/comparing/contrasting/givingdirections& suggestions.**(Remember – L1)**
- **CO4:** Write formal/informal dialogues with an understanding of verbal/non-verbal features of communication. Guess meanings of the words from the context.**(Understand – L2)**
- **CO5:** Write well-structured essays; Reports &Résumé.**(Apply – L3)**

UNIT - I

Fabric of Change- 'H.G. Wells and the Uncertainties of Progress – Peter J. Bowler'; Reading: Studying the use of Graphic elements in texts; Grammar & Vocabulary**:** Quantifying Expressions; Adjectives and adverbs; Comparing and Contrasting; Degrees of Comparison, Writing: Information Transfer

UNIT - II

Tools for Life - 'Leaves from the Mental Portfolio of a Eurasian – Sui Sin Far'; Reading: Global Comprehension; Detailed Comprehension; Grammar & Vocabulary**:** Active & Passive Voice; Idioms & Phrases; Writing: Structured Essays using suitable claims and evidence.

UNIT - III

'Homi Jahangir Bhabha';

Grammar & Vocabulary: Words often confused; Common Errors; Writing**:** Incident & Investigation Reports.

UNIT - IV

'Jagadish Chandra Bose'; Grammar & Vocabulary: Use of antonyms; Correction of Sentences; Writing**:** Dialogue Writing.

UNIT - V

'**Prafulla Chandra Ray'**; Grammar & Vocabulary: Analogy; Sentence Completion; Writing**:** Writing a Résumé

TEXT BOOKS:

1. Prabhavati. Y & et al, "English All Round – Communication Skills for Undergraduate Learners", Orient Black Swan, Hyderabad, 2019.
2 "The Great Indian Scientists" published by Cengage Learning India Pvt. Ltd., Delhi, 2017

REFERENCE BOOKS:

1. Swan,M., "Practical English Usage", Oxford University Press, 2016.
2. Kumar,S and Latha, P, "Communication Skills", Oxford University Press, 2018.
3. Rizvi Ashraf M., "Effective Technical Communication", Tata Mc Graw Hill, New Delhi, 2008.
4. BaradwajKumkum, "Professional Communication", I.K.International Publishing House Pvt.Lt., New Delhi, 2008.
5. Wood,F.T., "Remedial English Grammar", Macmillan, 2007.

B.Tech. (II Sem.)	20FE04 - LINEAR ALGEBRA AND TRANSFORMATIONTECHNIQUES	L	T	P	Cr.
		2	1	0	3

Pre-requisites: Nil

Course Educational Objective: In this course, students learn Matrix Algebra and introduced with transformation techniques such as Laplace Transforms and Z – Transforms.

Course Outcomes: At the end of the course, the student will be able to

CO1: Investigate the consistency of the system of equations and solve them. **(Apply – L3)**

CO2: Determine the eigen vectors and inverse, powers of a matrix using Cayley-Hamilton theorem.**(Apply – L3)**

CO3: Use the concepts of Laplace Transforms to various forms of functions.**(Understand – L2)**

CO4: Solve ordinary differential equations by using Laplace Transforms.**(Apply – L3)**

CO5: Apply Z - Transforms to solve difference equations.**(Apply – L3)**

UNIT – I

System of Linear Equations

Matrices - Rank- Echelon form, Normal form, PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non-Homogeneous system of equations.

UNIT – II

Eigen Values and Eigen Vectors

Eigen values – Eigen Vectors – Properties – Cayley-Hamilton Theorem – Inverse and Powers of a matrix by using Cayley-Hamilton Theorem.

UNIT – III

Laplace Transforms

Laplace transforms of standard functions –Linear Property - Shifting Theorems, Change of Scale Property

Multiplication and Division by‘t’ - Transforms of derivatives and integrals – Unit step function –Dirac’s delta function.

UNIT – IV

Inverse Laplace Transforms

Inverse Laplace transforms– Linear Property - Shifting Properties - Convolution theorem, Applications of Laplace transforms to ordinary differential equations.

UNIT – V

Z-Transforms

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z –transform - Convolution theorem – Solution of difference equation by Z-transforms.

Text Books:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH Publications, New Delhi, 2010.

Reference Books:

1. M. D. Greenberg, "*Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi,2011.
2. Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 8th Edition, John Wiley & sons, New Delhi,2011.
3. W.E. Boyce and R. C. Diprima, "Elementary *Differential Equations"*, 7th Edition, John Wiley & sons, New Delhi,2011

B.Tech. (IISem.) **20FE06 - ENGINEERING CHEMISTRY**

L	T	P	Cr.
3	0	0	3

Pre-requisites:Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts of chemistry and to provide them with the knowledge of industrial problems and finding the solutions. It helps to strengthen thebasic concepts ofelectrochemistry, corrosion, nanotechnology, polymers, liquid crystals and analytical techniques.

Course Outcomes: At the end of the course, students will be able to,

- **CO1:** Apply Nernst Equation for calculating electrode cell potentials and compare batteries for different applications.**(Apply – L3)**
- **CO2:** Apply principles of corrosion for design and effective maintenance of various equipment.**(Apply – L3)**
- **CO3:** Analyse the suitability of advanced materials like nano materials in electronics and medicine.**(Understand – L2)**
- **CO4:** Identify the importance of liquid crystals, polymers in advanced technologies.**(Understand – L2)**
- **CO5:** Apply the principles of analytical techniques in chemical analysis.**(Apply – L3)**

UNIT – I

Electro Chemistry & Batteries

Types of Electrodes -Calomel Electrode, Glass Electrode,Calculation of EMF of Cell,Applications of Nernst Equation & Electro chemical Series, Batteries -Lead-acid Battery, Lithium ion Battery, H_2 – O_2 Fuel Cell, Mg - Cu reserve battery.

UNIT – II

Science of Corrosion

Dry Corrosion (Direct Chemical corrosion) - Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases and liquid metal corrosion; Wet Corrosion (Electro Chemical corrosion) - Mechanism- oxygen absorption, hydrogen evolution, types of wet corrosion, Galvanic Corrosion, Concentration Cell Corrosion, passivity and Galvanic series; Factors Influencing Corrosion - Nature of metal (Purity, position in galvanic series, relative area of cathode & anode, nature of surface film) and nature of environment (temperature, humidity, atmospheric pollution and nature of ions in the medium); Control of Corrosion: Cathodic Protection - Sacrificial anode and impressed current methods, electro plating and metal cladding.

UNIT – III

Chemistry of Engineering Materials

Nano Materials - Extraordinary changes observed at nano size of materials and reasons, types of nano-materials, Gas-Phase Synthesis of nanomaterials, Applications; Materials in Electronic devices: Very brief note on raw materials that make IC units of CPU, GPU, RAM, PCBs, hard disks and other electronic devices with special reference to polymers;

Molecular Switches - Characteristics of Molecular motors and machines, Rotaxanes and Catenanes as artificial molecular machines, prototypes – linear motions in rotaxanes, an acid-base controlled molecular shuttle, molecular elevator, automated light-powered molecular motor.

UNIT – IV

Liquid Crystals & Polymers

Liquid crystals -Identification and structural aspects of molecules to form liquid crystals; Classification of liquid crystals - Thermo tropic liquid crystals and types, lyotropic liquid crystals. Mechanism of working of liquid crystals and applications; Polymers - Differences between thermoplasts and thermosets, Types of polymerization with examples; Plastics - Preparation properties and engineering applications of P.M.M.A, Teflon, Polycarbonate; Rubbers - Structure of raw rubber and vulcanized rubber, Preparation properties and engineering applications of Polyurethane, Buna-S, conducting polymers; Bio-degradable polymers - PLA & PGA (Polylactic Acid and Polyglycolic Acid).

UNIT – V

Analytical Techniques

Types of analysis; Physical analysis: Analysis of physical characteristics; Chemical analysis: Gravimetric and volumetric analysis (basic concept only);Instrumental analysis: Electro analytical techniques – Introduction; Conductometric techniques: strong acid-strong base and strong acid-weak base, weak acid -strong base and weak acid -weak base & advantages; Potentiometric techniques: Acid-base and oxidation-reduction titrations-advantages; Colorimetric techniques: Principle and determination of iron by using thiocynate as a reagent.

TEXT BOOKS

1. Shikha Agarwal, “A Text book of Engineering Chemistry”, Cambridge University Press, New Delhi, 1st Edition, 2015.
2. Jain, Jain, “A textbook of Engineering Chemistry”, Dhanpat Rai Publishing Company, New Delhi, 16th Edition, 2015.

REFERENCEBOOKS

1. Shashi Chawla, “A Text book of Engineering Chemistry”, Dhanpat Rai Publishing Company, New Delhi, 3rd Edition, 2003.
2. S.S. Dara, S.S. Umare, “A Text book of Engineering Chemistry”, S. Chand Publications, New Delhi, 12th Edition, 2010.
3. PrasantaRath, B. Rama Devi, Ch. VenkataRamana Reddy, SubhenduChakroborty, “Engineering Chemistry”, Cengage Learning India, 1st Edition, 2019.

20CS01 - PROGRAMMING FOR PROBLEM SOLVINGUSING C

B.Tech. (II Sem.)

L	T	P	Cr.
3	0	0	3

Pre-requisites: Nil

Course Educational Objective: The Objective of the course is to make learn the basic elements of C programming, control structures, derived data types, Modular programming, user defined structures, basics of files and its I/O operations.

Course Outcomes: At the end of the course, the student will be able to

CO1: Familiar with syntax and semantics of the basic programming language constructs.**(Understand - L2)**

CO2: Construct derived data types like arrays in solving a problem.**(Apply - L3)**

CO3: Decompose a problem into modules and reconstruct it using various ways of user-defined functions.**(Apply - L3)**

CO4: Define user-defined data types like structures and unions and its applications to solve problems.**(Apply - L3)**

CO5: Discuss various file I/O operations and its application.**(Understand - L2)**

UNIT – I

Introduction to Problem solving through C-Programming: Problem Specification, Algorithm / pseudo code, flowchart, examples.

C-Programming: Structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation.

Control statements: if, if else, else if ladder and switch statements, while, do-while and for statements, break, continue, goto and labels.

UNIT – II

Arrays- concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays.

Character Arrays: declaration, initialization, reading, writing strings, string handling functions, Pre-processor Directives, and macros.

Applications of Arrays: Linear search, Binary search, Bubble Sort.

UNIT – III

Pointers- concepts, declaring and initialization of pointer variables, pointer expressions, pointer arithmetic, pointers and arrays, pointers and character arrays, pointers to pointers.

Functions: basics, category of functions, parameter passing techniques, recursive functions-comparison with Iteration, Functions with arrays, Standard library functions, dynamic memory management functions, command line arguments.

Storage classes - auto, register, static and extern,

UNIT – IV

Derived types- structures- declaration, definition, and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef.

UNIT – V

Files – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.

TEXT BOOKS

1. ReemaThareja, Programming in C, Oxford University Press, 2nd Edition, 2015.

REFERENCE

1. Jeri R.Hanly, Elliot B.Koffman, Problem Solving and Program Design in C, Pearson Publishers, 7th Edition, 2013.
2. E Balagurusamy, Computer Programming, McGraw Hill Education, 8th Edition.
3. C: The Complete Reference, McGraw Hall Education, 4th Edition.
4. PradeepDey, Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition, 2011.
5. Stephen G.Kochan, Programming in C, Pearson Education, 3rd Edition, 2005.

B.Tech. (II Sem.) **20EC02 - DIGITAL LOGIC CIRCUITS**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Nil

Course Educational Objective: In this course student will learn about the basic concepts of number systems and Boolean algebra, logic gates and realization of Boolean expressions using logic gates, realization of combinational and sequential circuits and concepts of Finite State Machines and ASM Charts

Course Outcomes: At the end of the course, the student will be able to

CO1: Summarize the key differences between number systems and their usage in Digital electronics circuits.**(Understand – L2)**

CO2: Identify the minimization techniques of Boolean expressions to implement digital circuits using basic logic gates and logic circuits.**(Apply – L3)**

CO3: Apply the minimization and realization methods for design of Combinational and Sequential logic circuits.**(Apply – L3)**

CO4: Analyze the Combinational, Sequential, Finite state machines and Algorithmic State Machines for implementation of digital logic circuits.**(Analyze – L4)**

UNIT – I

Number Systems: Number systems (binary, Octal, Hexadecimal) 1's and 2's complement of binary numbers, Signed Binary numbers, Binary codes –BCD, Excess-3 code, Gray code, Error detecting and correcting codes – Hamming code.

UNIT – II

Boolean Algebra: Boolean postulates, De-Morgan's Theorem, Principle of Duality, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), minterm and maxterm, implementation of Boolean functions using Karnaugh map, minimization (up to 4 variables), K-map with don't care conditions, minimization of Boolean expressions using Quine-Mc Cluskey Tabular Method (5 variable).

Logic Gates: basic logic gates, realization of Boolean functions using logic gates, Multi-level gate implementations.

UNIT – III

Combinational Logic Circuits: Design procedure, Adders and Subtractors, Parallel adder/ Subtractor- Carry look ahead adder, BCD adder, Magnitude Comparator, Decoder, Encoder, Multiplexer, Demultiplexer, Parity generator/checker, code converters- binary to gray, gray to binary, BCD to Excess-3 codes.

UNIT – IV

Sequential Logic Circuits: Latches, Flip flops-SR, JK, T, D – Characteristic and excitation tables, Realization of one flip flop using other flip flops, Shift Registers, Universal Shift Register, Counters- Synchronous and Asynchronous counters. Implementation of 4-bit Counters.

UNIT – V

Finite state machines: Introduction to Mealy and Moore machines, Difference between Mealy and Moore machines, Conversion between Mealy and Moore machines.

Algorithmic State Machines: Features of ASM chart, System design using data path and control subsystems, control implementations.

TEXT BOOK

1. Morris Mano, "Digital Design", PHI Publishers, 4th Edition.
2. Ananda Kumar, "Switching Theory and Logic Design", PHI Publishers.

REFERENCES

1. ZviKohavi, Switching and Finite Automata Theory, TMH Publishers, 2nd Edition.
2. Charles H. Roth, "Fundamentals of Logic Design", Cengage learning Publishers.
3. M. Subramanyam, "Switching Theory and Logic Design", University Science Press Publishers.
4. John M. Yarbrough, "Digital Logic: Applications and Design", Thomson Publications.

B.Tech. (II Sem.) **20MC01 - CONSTITUTION OF INDIA**

L	T	P	Cr.
2	0	0	0

Pre-requisites: Nil

Course Educational Objectives

• To enable the student to understand the importance of constitution.

• To understand the structure of Executive, Legislature and Judiciary.

• To understand Philosophy of fundamental rights and duties.

• To understand the autonomous nature of constitution bodies like SupremeCourt and High Court Controller and Auditor General of India and ElectionCommission of India.

• To understand the Central and State relation, financial and administrative.

Course Outcomes: *At the end of the course, the student shall be able to*

CO1: Understand history and philosophy of constitution with reference to Preamble,Fundamental Rights and Duties(**Understand – L2**).

CO2: Understand the concept of Unitary and Federal Government along with therole of President, Prime Minister and Judicial System(**Understand – L2**).

CO3: Understand the structure of the state government, Secretariat, Governor and Chief Ministerand their functions(**Understand – L2**).

CO4: learn local administration viz. Panchayat, Block, Municipality and Corporation (**Understand – L2**).

CO5: learn about Election Commission and the process and about SC, ST, OBCand women(**Understand – L2**).

UNIT – I:

Introduction to Indian Constitution: 'Constitution' meaning of the term, IndianConstitution – Sources and Constitutional History, Features – Citizenship,Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT – II:

Union Government and its Administration Structure of the Indian Union: FederalismCentre – State relationship, President: Role, Power and Position. Prime Minister(PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, RajyaSabha. The Supreme Court and High Court: Powers and Functions.

UNIT – III:

State Government and its Administration Governor – Role and Position – ChiefMinister (CM) and Council of Ministers. State Secretariat: Organization, Structureand Functions.

UNIT – IV:

A Local Administration -- Role and Importance,Municipalities – Mayor and Role of Elected Representative,Panchayati Raj: Functions of PanchayatiRaj Institution, Zilla Panchayat, Elected Officials and their roles, Villagelevel – Role of Elected and Appointed officials.

UNIT – V:

Election Commission: Election Commission – Role of Chief Election Commissionerand Election Commissionerate State Election Commission: Functions andCommissions for the welfare of SC/ST/OBC and Women.

Reference Books

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall ofIndia Pvt.Ltd., New Delhi.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.A. Siwach, Dynamics of Indian Government and Politics.
4. D.C. Gupta, Indian Government and Politics.
5. H.M.Sreevai. Constitutional Law of India, 4th edition in 3 volumes (UniversalLaw Publication).
6. J.C. Johari, Indian Government and Politics Hans.
7. J.Raj, Indian Government and Politics.
8. M.V. Pylee, Indian Constitution, Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi.
9. Noorani, A.G. (South Asia Human Rights Documentation Centre), Challengesto Civil Right). Challenges to Civil Rights Guarantees in India, OxfordUniversity Press 2012.

E-Resources:

1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.
4. www.hss.iitb.ac.in/en/lecture-details.
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indianconstitution.

* * *

B.Tech. (IISem.) **20FE53 - ENGINEERING CHEMISTRY LAB**

L	T	P	Cr.
0	0	3	1.5

Pre-requisites: Nil

Course Educational Objectives: This course enables thestudents to analyze water samples and perform different types of volumetric titrations. It provides them with an overview of preparation of polymers and analytical techniques.

Course Outcomes: At the end of the course, the students will be able to,

CO1: Assess alkalinity of water based on the procedure given.**(Understand– L2)**

CO2: Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus.**(Understand– L2)**

CO3: Acquire practical knowledge related to preparation of polymers.**(Understand– L2)**

CO4: Exhibit skills in performing experiments based on theoretical fundamentals.**(Understand– L2)**

List of Experiments

(Any of the 10 experiments are required to be conducted)

Model Experiment

1. Determination of HCl using standard Na_2CO_3 solution.

Water Analysis

2. Determination of alkalinity of water sample.

ComplexometricTitrations

3. Estimation of $Mg^{+2}/Zn^{+2}/Ca^{+2}$ in given solution by using standard EDTA solution.

Preparation of Polymers (only demonstration)

4. Nylon Fibers
5. Bakelite

Redox Titrations

6. Estimation of Mohr's salt by using potassium permanganate.
7. Estimation of Mohr's salt by using potassium dichromate.
8. Estimation of copper(II) ion using standard hypo solution.

Conductometric Measurements

9. Estimation of amount of HClconductometrically using standard NaOH solution.
10. Estimation of amount of HClconductometrically using NH_4OH solution.

Potentiometric Measurements

11. Estimation of amount of HClpotentiometrically using NaOH solution.

Estimations

12. Measuring pH of the given sample solution using pH meter (demonstration only).
13. Estimation of Vitamin C in a given sample.

Colorimetric Analysis

14. Determination of Iron(III) by colorimetric method.

REFERENCES

Lab manual

B.Tech. (II Sem.)	20CS51 - PROGRAMMING FOR PROBLEM SOLVING USING C LAB	L	T	P	Cr.
		0	0	3	1.5

Pre-requisite : NIL

Course Educational Objective: The objective of the course is to learn the basic elements of C Programming Structures like Data Types, Expressions, Control Statements, and Various I/O Functions and to solve simple mathematical problems using control structures. Design and implementation of various software components, which solve real world problems.

Course Outcomes (CO): *At the end of this course, the student will be able to:*

CO1: Apply control structures of C in solving computational problems.**(Apply– L3)**

CO2: Implement derived datatypes & use modular programming in problem solving. **(Apply– L3)**

CO3: Implement user defined datatypes and perform file operations.**(Apply– L3)**

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.**(Apply– L3)**

# of modules at most 10can be taught and all the modules should be in line with theory.

Module 1: Introduction to Raptor Tool.

Module 2: Problem solving using Raptor Tool

Module 3: Exercise Programs on Basics of C-Program.

Module 4: Exercise Programs on Control Structures.

Module 5: Exercise Programs on Loops & nesting of Loops.

Module 6: Exercise Programs on Arrays & Strings.

Module 7: Exercise Programs on Pointers.

Module 8: Exercise Programs on Functions.

Module 9: Exercise Programs on user defined data types.

Module 10: Exercise Programs on Files.

B.Tech. (II Sem.) **20EC52 - DIGITAL LOGIC CIRCUITS LAB**

L	T	P	Cr.
0	0	2	1

Pre-requisites : Nil

Course Educational Objective: This course gives the ability to design and verify digital logic circuits like; logic gates, combinational and sequential logic circuits using discrete components and Integrated Circuits.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Demonstrate the functionality of Logic gates, Flip-flops, Shift registers and Counters.**(Understand – L2)**

CO2: Apply the Boolean minimization methods to implement Combinational and Sequential logic circuits using logic gates.**(Apply – L3)**

CO3: Analyze the behavior of Combinational and Sequential logic circuits.**(Analyze – L4)**

CO4: Adapt effective Communication, presentation and report writing skills. **(Apply – L3)**

List of Experiments

(Any of the 10 experiments are required to be conducted)

1. Realization of logic gates using universal logic gates.
2. Realization of Adder and Subtractor circuits using basic / universal gates.
3. Implementation of Binary to Gray and Gray to Binary code converters.
4. Realization of Boolean expressions using Decoder.
5. Implementation of 8×1 Multiplexer and Demultiplexer.
6. Realization of Boolean Expressions using Multiplexers.
7. Verification of flip-flops.
8. Conversion of SR to D flip-flop and SR to T flip-flop.
9. Implementation of shift register.
10. Implementation of Universal shift register.
11. Implementation of Up/Down counter.
12. Implementation of Synchronous /Asynchronous counter.

B.Tech. (II Sem.) **20ME51 - ENGINEERING WORKSHOP**

L	T	P	Cr.
0	0	3	1.5

Pre-requisites : Nil

Course Educational Objective: The objective of this course is to get familiarized with various trades used in Engineering Workshop and learn the safety precautions to be followed in the workshops while working with the different tools.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Develop different prototypes in the carpentry section.**(Understand – L2)**
CO2: Fabricate various basic prototypes in fitting trade. **(Understand – L2)**
CO3: Demonstrate various operations related to plumbing, tin smithy and black smithy.**(Understand – L2)**
CO4: Perform various basic house wiring techniques.**(Apply– L3)**

List of Experiments

(Conduct at least 4 Trades with 2 exercises from each Trade and demonstrate about 2 Trades)

Trade –1: CARPENTRY SHOP

Introduction to various types of wood such as Teak, Sal, Oak, Beach, Neam, Wallnut Mango, Shisham, Deodar, Babul. Demonstration, function and use of carpentry hand-tools and their safety precautions. Introduction to various types of wooden joints, their relative advantages and uses.

Job I - Marking, sawing, plaining and chiselling operations.
Job II - Preparation of half lap-joint
Job III – Preparation of Mortise and Tenon Joint

Trade –2: FITTING SHOP

Introduction to fitting shop tools, common materials used in fitting shop, description, demonstration, care, use of tools and safety precautions.

Job I- Making a L-Fit from a rectangular piece of Mild Steel (MS).
Job II-Making a T-Fit from a rectangular piece of MS.
Job III-Making a V-Fit from a rectangular piece of MS
Job IV-Making a Half round fit from a rectangular piece of MS.

Trade -3: TIN- SMITHY SHOP

Introduction to tin-smithy, specification and use of hand tools, accessories and the safety precautions.

Job I - Preparation of a rectangular tray.
Job II- Preparation of an open scoop/ funnel.
Job III - Preparation of a Single Seam Joint and Double Seam Joint.
Job IV - Preparation of a Corner Seam Joint.

Trade –4: PLUMBING SHOP

Introduction to plumbing – demonstration, use of hand tools, accessories and safety precautions.

Job I – preparation of pipe layout.
Job II – Pipe threading.

Trade -5: BLACK SMITHY

Introduction–demonstration of tools, equipment and safety precautions.

Job I – Preparation of S–Hook.

Job II – Preparation of Chisel

Trade -6: HOUSE WIRING

Demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVC Conduits. Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthling.

Job I – One lamp controlled by one one-way switch.

Job II – Two lamps in series and parallel connection with one-way switch.

Job III- Florescent lamp and calling bell circuit.

Job IV - One lamp connection with two 2- way switches (stair case connection).

Job V -- House wiring circuit.

REFERENCES

1. LBRCE Workshop Lab Manual.
2. S.K.HajraChoudary and A.K.Choudary, –Workshop Technology-I, MediaPromotersand Publishers Pvt.Ltd., Mumbai,2012.
3. B.S.Raghuvamsi, –Workshop Technology-I, Dhanpatrai and company, New Delhi, 2014.
4. P.Khannaiah,K.L.Narayana,–WorkshopManual,ScitechPublicationsIndiaPvt.Ltd, 2015.

20FE10 –Numerical Methods and Integral Calculus

B.Tech. (III-Sem.)

L	T	P	Cr.
2	1	0	3

Pre-requisites : None

Course Educational Objective: The main objective of this course is to enable the students learn
Numerical Techniques for solving the equations and apply interpolation techniques. They will also learn about the Fourier analysis of single valued functions, Multiple Integrals in different coordinate systems and Vector differentiation.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Estimate the best fit polynomial for the given tabulated data using Interpolation.(Understand – L2)
CO2: Apply numerical techniques in solving of equations and evaluation of integrals. (Apply – L3)
CO3: Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes. (Apply – L3)
CO4: Generate the single valued functions in the form of Fourier series and obtain Fourier series representation of periodic function. (Apply – L3)
CO5: Evaluate the directional derivative, divergence and angular velocity of a vector function. (Apply – L3)

UNIT – I

Interpolation and Finite Differences
Interpolation: Introduction – Finite differences- Forward Differences- Backward Differences- Central differences – Symbolic relations and separation of symbols-Differences of a polynomial- Newton's formulae for interpolation – Lagrange's Interpolation formula.

UNIT – II

Numerical Solution of Equations and Numerical Integration
Solutions of Algebraic and Transcendental Equations – Regula Falsi method and Newton Raphson Method in one variable.

Numerical Integration
Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT – III

Multiple Integrals
Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing the order of Integration.

UNIT IV

Fourier series

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

UNIT – V

Vector Differentiation

Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl –Irrotational fields-potential surfaces - Laplacian and second order operators

Text Books:

1. B.S. Grewal, "*Higher Engineering Mathematics*", 42nd Edition, Khanna Publishers, New Delhi, 2012.
2. B. V. Ramana, "*Higher Engineering Mathematics*", 1st Edition, TMH Publications, New Delhi, 2010.
3. S. S. Sastry, *"Introductory Methods of Numerical Analysis"* 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

Reference:

4. M. D. Greenberg, " *Advanced Engineering Mathematics*", 2nd Edition, TMH Publications, New Delhi,2011.

5. Erwin Krezig, *"Advanced Engineering Mathematics"* , 8th Edition, John Wiley & sons, New Delhi,2011.

6. W.E. Boyce and R. C. Diprima, " *Elementary Differential Equations"* , 7th Edition, John Wiley & sons, New Delhi,2011.

B.Tech. (III-Sem.) **20CS03 – DATA STRUCTURES**

L	T	P	Cr.
3	0	0	3

Pre-requisite : Programming Language

Course Educational Objectives:

The objective of the course is to make students familiar with writing algorithms to implement different data structures like stacks, queues, trees and graphs, and various sorting techniques.

Course Outcomes (COs): *At the end of this course, the student will be able to*

CO 1	Write the algorithms for various operations on list using arrays and linked list and analyze the time complexity of its operations.**(Understand-L2)**
CO 2	Apply linear data structures like stack and queue in problem solving. **(Apply -L3)**
CO 3	Demonstrate various searching and sorting techniques and compare their computational complexity in terms of space and time. **(Understand-L2)**
CO 4	Write the algorithms for various operations on binary trees,binary search trees and AVL trees. **(Understand-L2)**
CO 5	Demonstrate graph traversal techniques and hashing techniques. **(Understand-L2)**

UNIT - I

Algorithm Analysis:

Introduction to Algorithm, Algorithm Analysis , Asymptotic Notations.

Introduction to arrays and Abstract Data Type(ADT)

Lists: List using arrays and linked list- Singly Linked List, Doubly Linked List, Circular LinkedList.

UNIT – II

Stacks: Stack ADT,Implementation using arrays and linked list.

Applications of stacks : Infix to postfix expression conversion, Evaluation of Postfix expressions and balancing the symbols.

Queues:

Queue : Queue ADT,Implementation of Queue using arrays and linked list,circular queue, DEQUE

UNIT - III

Sorting: Bubble sort**,** Insertion Sort, Selection sort, Merge Sort, Quick Sort & Heap Sort

UNIT - IV

Trees: Introduction, Tree traversals, Binary Trees, Binary Search Trees, Balanced Binary search tree - AVL Trees and its operations.

UNIT - V

Graphs: Fundamentals, Representation of graphs, Graph Traversals: BFS, DFS.
Hashing: Hash Table, Hash Function, Collision resolution Techniques- separate Chaining, Open addressing, rehashing.

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd edition[1,2,3 units].
2. ReemaThareja, Data Structures using c, Oxford Publications[3,4,5].

REFERENCES:

1. Langson, Augenstein&Tenenbaum, 'Data Structures using C and C++', 2nd Ed, PHI.
2. RobertL.Kruse, Leung and Tando, 'Data Structures and Program Design in C', 2ndedition, PHI.

B.Tech. (III-Sem.) **20EC03 – ANALOG CIRCUIT DESIGN**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Fundamentals of Electronics.

Course Educational Objective: This course provides focus on h-parameter models, analysis, selection and proper biasing of transistors like BJT and FET, emphasis on working principles of BJT / FET amplifiers using appropriate equivalent models, gives importance to feedback in amplifiers to improve the amplifier characteristics, design of Oscillators, linear wave shaping Circuits and Multivibrators.

Course Outcomes: At the end of the course, the student will be able to

CO1: Identify the concepts of amplifier, Oscillator and linear wave shaping circuits at device level models.**(Understand – L2)**

CO2: Apply h-parameter models of the transistor for estimating gain, input resistance, and output resistance and feedback concepts at amplifier and oscillator circuits. **(Apply – L3)**

CO3: Analyze feedback concepts of amplifier, oscillator circuits, linear wave shaping Circuits and Multivibrators. **(Analyze – L4)**

CO4: Design transistorized amplifiers, oscillator circuits, linear wave shaping Circuits and Multivibrators using Devices and components.**(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	3	1	-	-	-	1	2	-	2	-
CO2	3	1	-	-	-	-	-	-	-	-	-	1	-	2	-
CO3	3	1	1	-	-	-	-	-	-	-	-	2	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	1	1	-	3	-

UNIT – I

Small Signal Amplifiers: Small signal modeling of transistor, h- parameter model of a Transistor; Analysis and Design of CE, CB and CC Amplifiers using exact & approximate models and analysis of CE Amplifier with emitter resistance.

FET Amplifiers: Analysis of CS and CD FET amplifiers.

UNIT – II

Multistage Amplifiers: Analysis and Design of Cascade Amplifier (RC Coupled Amplifier), Cascode Amplifier and Darlington Pair.

Frequency Response of Amplifiers: Frequency response of Single stage and Multi stage amplifiers; Effect of coupling capacitor and bypass capacitor on frequency response. The hybrid- π Common Emitter Transistor model; Hybrid- π Conductance in terms of low frequency h- parameters; The CE hybrid-π model - f_β , f_T and $f\alpha$; Current gain with resistive load.

UNIT – III

Power Amplifiers: Classification of large signal Amplifiers, Class A power amplifier- Direct coupled and Transformer Coupled; Class D, and Class E amplifier. Distortion in Amplifiers-Second harmonic Distortion and Higher order harmonic distortion.

UNIT – IV

Feedback Amplifiers and Oscillator: Classification of Amplifiers; The feedback concept; General characteristics of Negative feedback Amplifiers; Qualitative analysis of feedback Amplifiers-Voltage Series feedback Amplifier, Voltage Shunt feedback Amplifier, Current Series feedback Amplifier, Current Shunt feedback Amplifier and their analysis; and effect of feedback on frequency response of an amplifier.

Oscillator: Qualitative analysis of RC, LC and Crystal Oscillators.

UNIT – V

Introduction to linear wave shaping Circuits and Multivibrators: Low pass and High pass RC circuits and their response for sinusoidal, step, pulse, square and ramp inputs. RC circuit as differentiator, integrator and double differentiator; Bistable Multivibrator- self-biased transistor binary, Principle of operation, Analysis and Design of Bistable Multivibrators. Triggering types, Schmitt trigger circuit-Principle of operation, analysis and design, calculation of UTP, LTP and applications, Collector-coupled Monostable and Astable Multivibrators -Principle of operation, analysis and design.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, Electronic Devices and Circuits, Fourth reprint, Tata McGraw Hill, Publishers, New Delhi, 2011.
2. Anand Kumar A., Pulse and Digital Circuits, Third edition, PHI Publishers, 2005

REFERENCE

1. Donald A.Neamen, Electronic Circuit Analysis and Design, Second Edition, Tata McGraw Hill Publishers, 2014.
2. J.Millman and H.Taub, Pulse, Digital and Switching Waveforms, Second Edition McGraw-Hill Publishers, 2012.

B.Tech. (III-Sem.) **20EC04 – SIGNALS AND SYSTEMS**

L	T	P	Cr.
3	0	0	3

Pre-requisites : Vectors, Scalars, Approximation of a vector by another vector, Differentiation and Integration of signals

Course Educational Objective:

This course introduces signals and the way to perform mathematical operations on them. Further, it also introduces representation of signals in both time and frequency domains using orthogonal functions and describes Fourier series, the Fourier Transform and Laplace Transforms along with their properties. The course characterizes system behavior by estimating system response. It also introduces the concepts of sampling.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO1:	Summarize the basic concepts of signals , systems and their properties **(Understand – L2)**
CO2:	Examine the operations on signals and approximate using orthogonal functions.**(Apply – L3)**
CO3:	Apply the concept of impulse response to analyze the linear time invariantsystems **(Apply – L3)**
CO4	Analyze continuous time periodic and aperiodic signals using Fourier series, Fourier transform and Laplace transforms **(Analyze – L4)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	-		1
CO2	2	1	1	-	-	-	-	-	-	-	-		1		2
CO3	3	1	1	1	-	-	-	-	-	-	-	1			2
CO4	3	2	1	1	-	-	-	-	-	-	-	2	2		3

UNIT – I

Signal Analysis: Concept of Signal, Classification of Signals-Continuous Time and Analog Signals, Discrete Time and Digital Signals; Representation of Signals- Impulse, Unit Step, Unit Ramp, Signum, Decaying Exponential, Raising Exponential, Double Exponential, Gate and Rectangular, Sinc and Sampling Signals; Operations on Signals– Time Shifting, Time Scaling, Time Reversal (Folding), Amplitude Scaling, Convolution; Graphical Method of Convolution, Properties of Signals- Even and Odd, Causal and Non Causal, Bounded and Unbounded, Periodic and Aperiodic, Energy and Power, Deterministic and Random Signals.

UNIT – II

Signal Approximation: Approximation of a Signal by another signal-Mean square error, Condition for orthogonal signals, Approximation of a Signal by a set of mutually orthogonal signals-Evaluation of Mean square error, Gibbs Phenomena, Orthogonality in complex signals-Approximation of a complex signal by another complex signal, Approximation of a complex signal by a set of mutually orthogonal complex signals.

Fourier Series: Concept of Fourier Series, Trigonometric Fourier Series, Exponential Fourier Series, Relations among coefficients of Trigonometric Fourier Series and Exponential Fourier

Series, Existence of Fourier Series, Representation of Periodic signal by Fourier series over the entire interval, Symmetry conditions of Fourier Series, Parseval's Theorem.

UNIT – III

Fourier Transforms: Need for Transform, Deriving Fourier Transform from Fourier Series, Existence of Fourier Transform, Properties of Fourier Transform- Symmetry, Linearity, Scaling, Time Reversal, Time Shifting, Frequency Shifting, Time Differentiation, Time Integration, Frequency Differentiation, Frequency Integration, Time Convolution, Frequency Convolution and Parseval's Theorem, Fourier Transform of Periodic Signals.

Sampling Theorem: Representation of continuous time signals by its samples, Graphical and analytical proof of sampling theorem for Band Limited Signals, Nyquist rate and interval ,Types of sampling-Ideal sampling, flat top sampling, natural sampling, Reconstruction of signal from its samples, effect of under sampling- Aliasing, Difference between low pass sampling and band pass sampling.

UNIT – IV

Signal Transmission Through Linear Systems: Definition of System, Classification of Systems - Linear and Non Linear, Time Invariant and Variant, Causal and Non Causal, Stable and Unstable, Static and Dynamic, Invertible and Non-invertible; Signal and System Bandwidth, Response of Linear Systems-Transfer Function, Impulse Response, Response of Linear Systems with an arbitrary input, Distortion less Transmission through a system, Physically Realizable System and Poly-Wiener Criterion.

UNIT – V

Laplace Transforms: Concept of Laplace Transform on Non-Causal, Causal and Anti-Causal Signals, Relation between Laplace Transform and Fourier Transform, Existence of Laplace Transform; Properties of Laplace Transform- Linearity, Time Scaling, Time shifting, Shifting in S domain, Conjugate, Differentiation in time domain, Integration in time domain, Differentiation in S-domain, Integration in S-domain, Convolution in time domain, Convolution in S-domain, Initial value and Final value theorem. Laplace Transform of various classes of Signals, Concept of Region of Convergence and Properties, Inverse Laplace Transform using Partial Fractions Method. Applications of Laplace Transform: Causality of a System, Stability of a System, Solving of Differential Equations and Analysis of RLC Circuits.

TEXT BOOKS

1. A V Oppenheim, A S Wilsky and IT Young, "*Signals and Systems*", PHI learning, 2nd Edition,2018.
2. B P Lathi,"*Signals, Systems and Communications*", BS Publications, 2003.

REFERENCES

1. Simon Haykin, Barry Van VeenBairy , "*Signals and Systems*", John Wiley, 1st edition,2005.
2. P. Ramesh Babu, R.Ananda Natarajan "*Signals and Systems*", ScitechPublications , 2nd edition,2006.

B.Tech. (III-Sem.)	20EC05 – Random variables and stochastic processes	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Probability theory, Basics of differentiation and integration

Course Educational Objective:

This course provides the knowledge on random variables and their statistical properties. It will also give an idea about differences between random variables and random processes. It also describes the information of temporal and spectral characteristics of random variables and processes. The course explains about the response of a system for given input.

Course Outcomes: At the end of the course, the student will be able to

CO1: Summarize the concepts of random variables, random processes andnoise.**(Understand – L2)**

CO2: Use the mathematical concepts of random variables and random processesfor determining statistical parameters and spectral characteristics ofrandom processes. **(Apply – L3)**

CO3: Analyze the behavior of random variables and random processes using distribution and density functions.**(Analyze – L4)**

CO4: Apply the knowledge of random variables and processes for analyzing thesystem behavior **(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	2	1	-	-
CO4	3	3	1	1	-	-	-	-	-	-	-	2		-	3

UNIT – I

Random Variables: Concept of random variable, Condition for a function to be a random variable, Classification of a random variable, Cumulative distribution function and properties, Probability density function and properties, Different distributions-Binomial, Poisson, Uniform, Exponential, Rayleigh, Gaussian functions.

Operations on One Random Variable: Expectation, Moments, Moment about the origin, Central moments, Variance, Skew, Skewness, Characteristic function, Moment generating function (Proofs not expected), Transformations of a random variable.

UNIT – II

Multiple Random Variables: Introduction, Joint distribution function and properties, Marginal distribution function, Joint density function and properties, Marginal density function, statistical independence, Distribution and density of sum of random variables,Central Limit Theorem (Proof not expected).

Operations on Multiple Random Variables: Expected value of a function of random variables, Joint moment about the origin, Correlation, Joint central moments, Covariance, Correlation coefficient, Jointly Gaussian random variables - two random variables, Properties of Gaussian random variables.

UNIT – III

Stochastic Processes-Temporal Characteristics: Concept of stochastic processes, Classification of stochastic processes, Distribution and density of stochastic processes, Statistical independence, Stationarity - First-Order stationery processes, Second-Order and wide-Sense stationery processes, N^{th} -Order and Strict-Sense stationery processes. Time Averages , Ergodicity - Mean-Ergodic processes, Correlation Ergodic Processes, Correlation Functions- Autocorrelation function and properties, Cross-Correlation function and properties, Covariance function- Auto covariance function, Cross covariance function.

UNIT – IV

Stochastic Processes-Spectral Characteristics: Power density spectrum of processes and properties, Wiener-Khintchine relation, Bandwidth of power density spectrum, Cross Power density spectrum and properties, Relation between cross Power density spectrum and cross-correlation function.

UNIT – V

Linear Systems with Random Inputs: Response of a Linear system**,** Mean value of system response, Mean squared value of system response, Autocorrelation function of response, Cross correlation function of input and output, Power spectral density of response, Cross power spectral density of input and output.

Noise: Classification ofNoise, Modeling of Noise Sources-Resistive (Thermal) Noise, Arbitrary Noise Sources, Effective Noise Temperature, Available Power Gain, Noise Figure, White Noise, Introduction to additive white Gaussian Noise.

TEXT BOOKS

1. Peyton Z. Peebles, Jr, *"Probability, Random Variables and Random Signal Principles"*, Tata Mc Graw-Hill, 4^{th} edition,2010.
2. Y Mallikarjuna Reddy, "*Probability theory and Stochastic Processes*", Universities Press (India), Pvt Ltd,2010.

REFERENCES

1. George Kennedy, Davis, *"Electronic Communication Systems"*, Tata McGraw Hill Education, 4^{th} edition, 1999.
2. Hwei Hsu, "*Probability, Random Variables and Random Processes*", Schaum's Outline series, Tata McGraw-Hill Publishers, 3^{rd} Edition, 2014.

B.Tech. (III-Sem.) **20CS53 – DATA STRUCTURES LAB**

L	T	P	Cr.
0	0	3	1.5

Pre-requisite : Programming Language

Course Educational Objectives :

The objective of this course is to make students familiar with writing algorithms to implement different data structures like stacks, queues, trees and graphs, and various sorting techniques.

Course Outcomes (COs): *At the end of this course, the student will be able to*

CO 1	Implement Linear Data Structures using array and Linked list.
CO 2	Implement Various Sorting Techniques.
CO 3	Implement Non Linear Data Structure such as Trees &Graphs.

I)Exercise Programs on List ADT

a) Implementation of List using Arrays.

b) Implementation of List using Linked List.

II) Exercise Programs on Stacks & Queue ADT

a) Implementation of Stack Operations using Arrays.

b) Implementation of Stack Operations using Linked List.

c) Implementation of Queue Operations using Arrays.

d) Implementation of Queue Operations using Linked List.

III) Exercise Programs on Stack Applications

a) Conversion of Infix Expression to postfix Expression.

b) Conversion of Infix Expression to prefix Expression.

c) Evaluation of Postfix Expression

d) Implementation of Balancing Symbols.

IV) Exercise Programs on Types of Queues

a) Implementation of Circular Queues Linked List.

b) Implementation of Double Ended Queue using Arrays.

c) Implementation of Double Ended Queue using Linked List.

V) Exercise Programs on Sorting Techniques.

a) Implementation of Insertion Sort and

b) Implementation of Selection Sort.

c) Implementation of Merge Sort.

d) Implementation of Quick Sort.

e) Implementation of Bubble Sort.

f) Implementation of Heap Sort.

VI) Exercise Programs on Trees

a) Implementation of Binary Tree Traversals.

b) Implementation of Binary Search Tree Operations.

VII) Exercise Programs on Graph Traversal Techniques.

a) Breadth First Search (BFS) b) Depth First Search (DFS)

B.Tech. (III-Sem.) **20EC53 – ANALOG CIRCUIT DESIGN LAB**

L	T	P	Cr.
0	0	2	1

Pre-requisites: Fundamentals of Electronic Devices

Course Educational Objective: This course provides the practical exposure on designing of different single stage and multistage stage amplifiers, effect of capacitances on frequency response, analysis of power and feedback amplifiers.

Course Outcomes: At the end of the course, the student will be able to

CO1: Demonstrate the characteristics of Amplifiers, Oscillators, feedback amplifiers, and Multivibrators.**(Understand – L2)**

CO2: Apply the knowledge of capacitances on frequency response, Timer circuits and its applications.**(Apply – L3)**

CO3: Design of feedback amplifiers, Power amplifiers and waveform generators using Electronic devices and components.**(Create – L6)**

CO4: Adapt effective Communication, presentation and report writing skills **(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	1	1	1	2	-	-	-	-	-	-	-	1	-	2	-
CO4	-	-	-	-	-	-	-	-	3	2	-	-	-	3	-

LIST OF EXPERIMENTS

(The following experiments are to be simulated using PSPICE/MULTISIM software and Verified by hardware modules)

(Any of the 10 experiments are required to be conducted)

1. Determination of Gain and Bandwidth of Common Emitter (CE) Amplifier from the frequency response.
2. Determination of Gain and Bandwidth of Common Source (CS) FET Amplifier from the frequency response.
3. Design of two stage RC Coupled amplifier.
4. Verify conduction angles of Class-A and Class-B Power Amplifiers.
5. Design of Transistorized Current series Feedback amplifier for Bandwidth improvement.
6. Analysis of Stabilization of Gain of Transistorized Voltage series Feedback amplifier.
7. Analysis of Stabilization of Gain of Transistorized Current shunt Feedback amplifier.
8. Design and Realization of Transistorized RC Phase shift Oscillator to generate a sinusoidal signal.

9. Design and Realization of Transistorized Colpitts Oscillator to generate a sinusoidal signal.
10. Design and Realization of Low pass and High Pass filters using RC networks.
11. Design and Realization of Transistorized AstableMultivibtartor for the generation of square waveform.
12. Design and Realization of Transistorized Monostable Multivibrator for the generation of voltage pulses.

B.Tech. (III-Sem.) **20EC54 – DIGITAL SYSTEM DESIGN LAB**

L	T	P	Cr.
1	0	2	2

Pre-Requisites: Digital Electronics

Course Objectives: This course provides practical exposure in Xilinx compiler and in-built simulator to describe the simulation of digital circuits using Verilog HDL and explain Verilog HDL programs to generate test bench simulations.

Course Outcomes (COs): At the end of the course, students are able to

CO 1	Demonstrate the functionality of logic gates using Verilog HDL simulator.**(Understand – L2)**
CO 2	Analyze the behaviour of combinational and sequential circuits using Verilog HDL simulator.**(Analyze – L4)**
CO 3	Understand the functionality of memories using Verilog HDL simulator.**(Understand – L2)**
CO 4	Adapt effective communication, presentation and report writing.**(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	-	-	-	-	-	-	1	-	2	-
CO2	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO3	3	2	3	2	3	-	-	-	-	-	-	2	-	3	-
CO4	3	2	2	1	-	-	-	-	-	-	-	2	-	2	-

Unit-I:

Introduction to Verilog HDL, levels of design abstraction, System Tasks, Test benches, Language constructs and conventions.

Gate level Modeling: Logic gate primitives, Module structure, Tri state gates, array of Instances of Primitives

Unit-II:

Switch level modeling: Basic switch primitives, CMOS switch, Bi directional gates, Time delays with switch primitives, CMOS NOT, NAND, NOR gate using switch primitives.

Behavioral level modeling: Operations and assignments, functional bifurcation, multiple always blocks, blocking and non blocking assignments, case statement.

Data flow level modeling: Continuous assignments structures, Delays and continuous assignments, assignments to vectors, operators.

Note: Minimum 12 experiments to be conducted.

1. Implementation of Logic Gates – data flow model and behavioral model.
2. Combinational logic circuits – adders and subtractor.
3. Code converters- binary to gray and gray to binary.
4. 3 to 8 Decoder –74138.
5. 4 Bit Comparator –7485.
6. 8 x 1 Multiplexer – 74151 and 1X4 Demultiplexer – 74155.
7. 16 x 1 Multiplexer – 74150 and 4X16 Demultiplexer –74154.
8. Sequential circuits -Flip-Flops.
9. Decade counter –7490.
10. Synchronous & Asynchronous Counters using D & T- Flip Flops.
11. Shift registers –7495.
12. Universal shift registers –74194/195.
13. RAM (16 x 4) – 74189 (Read and Write operations).
14. Creating a Hierarchical Design.

B.Tech. (III-Sem.)	20ECS1-SIGNAL MODELING AND ANALYSIS	L	T	P	Cr.
		1	0	2	2

PREREQUISITE: Matrices and trigonometric functions.

COURSE EDUCATIONAL OBJECTIVE (CEO):

In this course, student will learn about basic signal modeling and analysis concepts like generations of signals using trigonometric function, solving linear equations and analyzing time function in frequency using MATLAB software.

Course Outcomes (COs): At the end of this course, students will be able to

CO1: Understand the programming concept of plotting trigonometric function, linear equations solutions in MATLAB.

CO2: Analyze the time frequency relations of signals.

UNIT – I: MATLAB Basics
Introduction to MATLAB, MATLAB windows, On-line help, Input-output, File types, platform dependence, General command, Programming in MATLAB, Script Files and Function Files: Executing a function. Plotting Graphs.

UNIT – II: Linear Algebra and Signal Operations
Solving a linear system, Gaussian elimination, Cramer's rule, Finding eigenvalues and eigenvectors, Vector operations, Element-by-element operations, Continuous time signals, operations on signals, convolution, frequency analysis.

TEXTBOOK:
1.Rudra Pratap., Getting started with MATLAB: A Quick Introduction for Scientists and Engineers.
2.B.P. Lathi., Principles of LINEAR SYSTEMS and SIGNALS, second edition, OXFORD University PRESS.

REFERENCES:
1. Larry E. Knop .,Linear Algebra: A First Course with Applications.

HANDS – ON LABORATORY SESSIONS

1. Plot the graph for the given function

$$f(t)=\sin(2\pi 10t + \pi/6)$$

2. Generate function f(t) by performing product operation on two given functions h(t) and g(t).

$$h(t) = \sin(2\pi 10t + \pi/6) \text{ and } g(t) = e^{-10t}$$

3. Solving linear equations using row reduced echelon form

$$5x - 3y + 2z=10$$

$$-3x + 8y + 4z = 20$$

$$2x + 4y-9z= 9$$

4. Solving linear equations using Cramer's methods

$$x+ y +z = 11$$

$$2x -6y -z = 0$$

$$3x + 4y+ 2z = 0.$$

5. Compute Eigen values and Eigen vectors of given matrix.

A= [5 -3 2; -3 8 4; 4 2 -9];

6. Consider $h_k(t) = e^{-\beta t} sin\ (2\pi 10t + \pi/6)$ where β=[0,1,….,10] and plot the family of curves over a time over $0 \leq t \leq 0.2$.

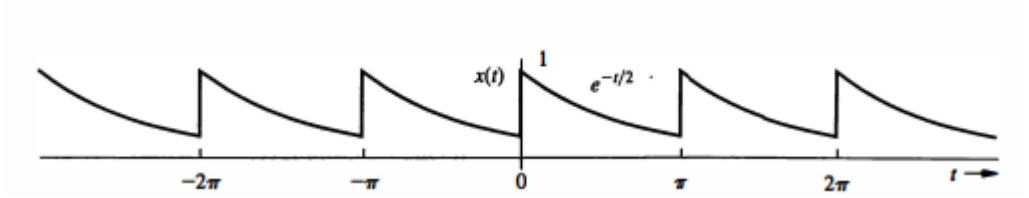
7. Generation of continuous time signals.

8. Basic operations on the signals.

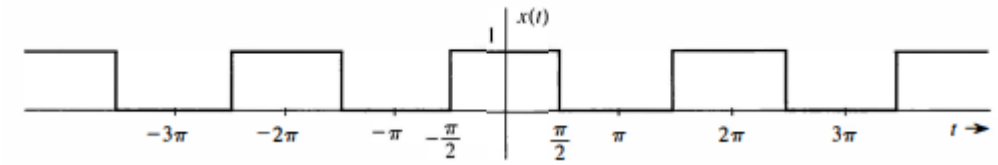
9. Convolution of signals.

10. Transformation of signals into time and frequency domains.

11. Compute and plot the Fourier coefficients for the periodic signal given signal.



12. Demonstrate the synthesis of the square wave by successively adding of the Fourier components of given signal.



B.Tech. (IV-Sem.)	20HS01 – Universal Human Values 2: UNDERSTANDING HARMONY	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Nil

Course Educational Objective: To become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

COURSE OUTCOMES: At the end of the course, the student will be able to-

CO1: Apply the value inputs inlife and profession **(Apply – L3)**

CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body **(Understand – L2)**

CO3: Understand the role of a human being in ensuring harmony in society **(Understand – L2)**

CO4: Understand the role of a human being in ensuring harmony in the nature and existence. **(Understand – L2)**

CO3: Distinguish between ethical and unethical practices (**Apply – L3**)

UNIT-I: Need, Basic Guidelines, Content and Process for Value Education

'Natural Acceptance' and Experiential Validation- as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer);

Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship;

Understanding the harmony in the society: Resolution, Prosperity, fearlessness and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family, Gratitude as a universal value in relationships.

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics, Strategy for transition from the present state to Universal Human Order

Text Book:

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

B.Tech. (IV-Sem.) **20EE09 – CONTROL SYSTEMS**

L	T	P	Cr.
2	1	0	3

Pre-requisites: Electrical circuit Analysis and Applied Physics

Course Educational Objective: The objective of this course is to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Develop mathematical models of systems in terms of transfer function and state-space. **(Apply-L3)**

CO2: Analyze control systems in time domain **(Apply-L3)**

CO3: Analyze control systems in frequency domain **(Apply-L3)**

CO4: Understand the concepts of controllers and compensators. **(Understand-L2)**

UNIT-I: MATHEMATICAL MODELLING OF CONTROL SYSTEMS

Concepts of Control Systems- Open Loop and Closed Loop control systems. Mathematical modeling –Transfer function, Modeling of electrical systems, mechanical systems, Electrical analogy of mechanical systems. Block diagram representation of systems - Block diagram algebra. Signal flow graph – reduction using Mason's gain formula. Feedback Control System Characteristics- Sensitivity of Control Systems to Parameter Variations, Disturbance Signals in a Feedback Control System.

UNIT – II: TIME RESPONSE ANALYSIS-I

Standard test signals, Step response of first order and second order systems, Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).

UNIT – III: TIME RESPONSE ANALYSIS-II

Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis- Introduction to Root Locus Technique, Construction of root loci.

UNIT – IV: FREQUENCY RESPONSE ANALYSIS

Frequency domain specifications, Frequency response of standard second order system. Bode Plot - determination of frequency domain specifications - phase margin and gain margin, determination of transfer function from the Bode Plot. Polar plot, Nyquist plot- Nyquist Stability criteria. Introduction to Lag, Lead, Lead-Lag Compensator (excluding design).

UNIT – V: STATE SPACE ANALYSIS

Concept of state variables – State models for linear and time invariant Systems – The Transfer Function from the State Equation, Solution of state equation– State transition matrix and it's properties Concepts of controllability and observability.

TEXT BOOKS:

1. B. C. Kuo , "Automatic Control Systems" John Wiley and Sons ,9th edition,2014.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited Publishers,6th edition,2018.

REFERENCE:

1. Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 5th edition,2009
2. Norman S. Nise, Control Systems Engineering, 8th Edition, John Wiley, New Delhi,
3. Richard C Dorf, Robert H Bishop, Modern control systems, 12thedition, Prentice Hall (Pearson education, Inc.), New Delhi 2010.
4. Benzamin C. Kuo and Farid Golnaraghi, Automatic Control Systems,10th dition, John Wiley, New Delhi, 2017.
5. Rao V. Dukkipati,"Analysis and Design of Control Systems using MATLAB", NewAge Publishers, 2e, 2009.

B.Tech. (IV-Sem.) **20EC06 – DIGITAL SIGNAL PROCESSING**

L	T	P	Cr.
3	0	0	3

Pre-requisites : Signals & Systems

Course Objectives:

This course introduces discrete time signals and systems and operations performed on them. It introduces Discrete time Fourier Transform, Discrete Fourier transform and Z transform meant for spectral analysis of discrete time signals and systems. Fast Fourier Transform that is an efficient way of implementing DFT is also introduced. It also provides the basic knowledge about the design of both IIR and FIR filters.

Course Outcomes: At the end of the course, the student will be able to :

CO1: Interpret the basics of discrete time signal processing techniques.**(Understand – L2)**

CO2: Examine Discrete Time Signals in time and frequency domain using DTFT, DFT, FFT and Z-transforms**(Apply – L3)**

CO3: Apply DFT, FFT and Z-Transform techniques to solve and realize discreteSystems **(Apply – L3)**

CO4: Construct the IIR Filters using Butterworth, Chebyshev Approximation techniques and FIR Filters using Fourier series method and windowing Techniques **(Create – L6)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	2	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO3	3	3	1	1	-	-	-	-	-	-	-	2	-	-	2
CO4	3	3	2	1	-	-	-	-	-	-	-	3	-	-	2

UNIT – I

Digital Signal Processing System (DSP) – block diagram, Advantages, Limitations and Applications of DSP system.

Discrete Time Signals: Discrete time signals - Impulse, Unit Step, Unit Ramp, Rectangular, Exponential signals, Representation of discrete time signals, Operations on signals - Time shifting, Time scaling, Time reversal, Amplitude scaling, Properties of signals - Even/Odd signals, Causal/Non-Causal signals, Bounded/Unbounded signals, Periodic/Aperiodic signals, Energy/Power signals.

Discrete Time Systems: Properties of discrete time systems- Linear and Nonlinear, Shift Invariant and Variant, Causal and Non Causal, Stable and Unstable, Static and Dynamic, IIR and FIR systems. Analysis of LTI Systems through LCCDE – Natural Response, Forced Response,Response of Linear shift invariant systems-Linear convolution

Discrete Time Fourier Transform: DTFT of a sequence and system, Frequency response, Magnitude response and Phase response. Properties of DTFT- Linearity, Periodicity, Time shifting, Frequency shifting, Time reversal, Conjugate and Parseval's theorem.

UNIT – II

Z-Transform: Z-Transform of Causal, Anti-Causal and Non-Causal sequence. Region of Convergence and Properties, Properties of Z-Transform - Linearity, Time shifting, Time reversal, Multiplication by exponential sequence, Scaling in Z-domain, Conjugate, Differentiation in Z-domain, Time Convolution, Initial Value and Final Value Theorem, Inverse Z-Transform through Long Division, Partial Fractions and Residue Methods, Analysis of LTI system using z-transforms – system function, causality, stability , solution of difference equation, impulse response and step response.

Realization of Discrete Systems: Direct Form-I, Direct Form-II or Canonic Form, Cascade Form and Parallel Form for IIR and FIR systems.

UNIT – III

Discrete Fourier Transform: Frequency sampling - DFT, Computation of DFT, Computation of IDFT, Relation between DTFT and DFT, Properties of Twiddle factor, Properties of DFT- Linearity, Periodicity, Time shifting, Frequency shifting, Time reversal, differentiation in frequency domain, Conjugate, Parseval's theorem, Circular convolution, Additional DFT properties, Linear Convolution through Circular Convolution, Circular Convolution through DFT and IDFT, Linear Convolution through DFT and IDFT.

Fast Fourier Transform: Need for FFT, Radix-2 Decimation in Time FFT Algorithm, Radix-2 Decimation in Frequency FFT Algorithm, Comparison between DIT and DIF Algorithms, Inverse FFT.

UNIT – IV

IIR Filters: Design of IIR digital filters - Impulse Invariant Transformation, Bilinear Transformation. Specifications of Low Pass Filter, Analog Butterworth Filter, Design of Low Pass Digital Butterworth Filter, Analog Chebyshev Filter, Design of Low Pass Digital Chebyshev Filter, Analog Frequency Transformations.

UNIT – V

FIR Filters: Comparison between FIR and IIR Filters, Characteristics of FIR filters with linear Phase, Frequency Response Linear Phase FIR filters, Design of FIR filters - Fourier series method, Windowing Techniques-Rectangular Window, Hanning Window, Hamming Window, Kaiser Window.

TEXT BOOK(S)

1. John G. Proakis, Dimitris G. Manolakis *"Digital Signal Processing, Principles, Algorithms & Applications"*, Pearson education, 4th edition, 2008
2. Alan V Openheim, Ronald W. Schafer, *"Digital Signal Processing"*, PHI learning, 1st edition, 2010.

REFERENCE(S)

1. P.RameshBabu, *"Digital Signal Processing"*, Scitech Publications, 4th edition, 2012Pvt Ltd.
2. A.NagoorKani, *"Digital Signal Processing"*, RBA Publications,1st edition, 2005.

B.Tech. (IV-Sem.) **20EC07 – ANALOG COMMUNICATIONS**

L	T	P	Cr.
3	0	0	3

Pre-requisites : Signals & Systems

Course Educational Objective: This course provides the knowledge on various analog modulation techniques in both time and frequency domains. The course will give an idea about generation and demodulation methods of various analog modulation techniques. It also gives the complete information regarding the transmitters and receivers types and performance evaluation of continuous wave modulation schemes.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Understand the fundamental concepts of various analog modulation schemes with relevant time and frequency domain representations.**(Understand – L2)**
CO2	Interpret the generation, detection of continuous wave and pulse analog modulation techniques. **(Understand – L2)**
CO3	Apply the concepts of analog modulation and demodulation techniques for calculating communication system related parameters.**(Apply – L3)**
CO4	Analyze the performance of continuous wave modulation schemes in the presence of channel noise.**(Analyze – L4)**

Course Articulation Matrix (Correlation between COs & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	2	1	-	-
CO2	2	2	1	-	-	-	-	-	-	-	-	2	2	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	2	3	-	-
CO4	2	3	1	1	-	-	-	-	-	-	-	3	3	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

Pre-requisites: Signals and Systems

UNIT-I

Introduction to Communication System: Elements of Communication System, Need for Modulation, Classification of Modulation.

Amplitude Modulation: Time and Frequency Domain Representation of AM, Power relations in AM wave, Generation of AM waves: Square law Modulator, Switching Modulator, and Demodulation of AM wave**:** Square law demodulator, Envelope detector.

Double Side band Suppressed Carrier Modulation: Time and Frequency domain representation, Generation of DSBSC: Balanced modulator & Ring Modulator, Coherent Detection of DSBSC wave, Costas Loop.

UNIT-II

Single Side band Modulation: Time and Frequency domain representation, Generation of SSBSC: Filter Method& Phase-shift Method, Coherent detection of SSB wave.

Vestigial Side Band Modulation:

Introduction to Vestigial Side band Modulation, Generation of VSB modulated wave, Time domain description, Envelop Detection of a VSB plus carrier, Comparisons of AM Techniques, Applications of different AM Systems.

UNIT-III

Angle Modulation: Types of Angle Modulation, Frequency Modulation: Time domain representation, Single tone Frequency Modulation, Time and Frequency Domain representation of Narrow Band Frequency Modulation and wide band Frequency Modulation (Derivation not required), Transmission power and Band width of FM wave, Generation of FM waves: Indirect FM, Direct FM.

Demodulation of FM wave: Frequency Discrimination method: Simple slope detector, Balanced Slope detector, Phase Discrimination method: Foster Seeley Discrimination method, Ratio detector, Phase Locked Loop.

UNIT-IV

Radio Transmitters: Classification of Transmitters, AM Transmitter: Low level, high level AM Transmitters, FM transmitters: Reactance tube and Armstrong Method of FM transmission.

Radio Receivers:

Tuned Radio Frequency receiver, and its Limitations, Need for heterodyning, AM Super Heterodyne Receiver, Frequency Changing and Tracking, Concept of Intermediate Frequency, Automatic Gain Control: Simple AGC, Delayed AGC, FM receiver.

UNIT-V

Noise in Analog Communication Systems: Noise in communication system, Signal to Noise ratio calculations in AM, DSBSC, SSBSC systems, Signal to Noise ratio in FM receiver, Threshold Effect, Pre-Emphasis and De Emphasis circuits, Introduction to CNR,SINR.

Analog Pulse Modulation: Need for Pulse Modulation, Types of Pulse analog Modulation**,** Pulse Amplitude Modulation Generation and Demodulation, Pulse Width Modulation Generation and Demodulation, Pulse Position Modulation Generation and Demodulation.

Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing.

TEXT BOOKS

1. Simon Haykin, *"Communication Systems"*, John Wiley & Sons, 2nd Edition, 1983.
2. George Kennedy ,Davis, *"Electronic Communication Systems"*, Tata McGraw Hill Education, 4th edition, 1999

REFERENCE BOOKS

1. G.K.Mithal, *"Radio Engineering", Khanna Publishers,20th Edition,2000*
2. Sanjay Sharma, *"Analog Communication Systems",*S.K.Katariya& Sons,2nd Edition, 2007

B.Tech. (IV-Sem.)	20EC08 – ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	L	T	P	Cr.
		3	0	0	3

Pre-requisites : Vector Algebra, Coordinate System, Vector Calculus

COURSE OBJECTIVE: This course is useful to impart knowledge on electric and magnetic fields in both static and dynamic domains. The course will introduce the application of Maxwell's equations. The course gives the complete information regarding the Electromagnetic wave propagation in different mediums. This course will help in the analysis of transmission line using circuit theory and use the Smith chart to find reflection coefficient, VSWR, impedance in easy way.

COURSE OUTCOMES: At the end of the course, student will be able to

CO1	Define the basic laws that govern Electrostatic and Magnetostatic Fields.**(Understand – L2)**
CO2	Understand the basic concepts of Electro Magnetic fields in static and time varying conditions.**(Understand – L2)**
CO3	Apply the Electromagnetic concepts to different mediums (air,Dielectric media)**(Apply – L3)**
CO4	Analyze the characteristics of EM wave propagation in different unbounded and bounded mediums.**(Analyze – L4)**

COURSE ARTICULATION MATRIX(Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	3	-	-
CO3	2	3	2	1	1	1	-	-	-	-	-	2	3	-	-
CO4	2	3	2	1	1	-		-	-	-	-	2	3	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

UNIT-I

Electrostatics: Coulombs Law, Electric Field Intensity, Continuous Charge Distributions, Electric Flux Density, Gauss's Law, Applications of Gauss's Law, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Electric Dipole Moment, Electrostatic Energy Density, Poisson's and Laplace's Equations. Capacitance of different capacitors.

UNIT-II

Magnetostatics: Biot-Savart's Law, Ampere's Circuit Law, Applications of Ampere's Circuit Law, Magnetic Flux Density, Maxwell's two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials. Force due to Magnetic Field, Magnetic Energy Density and Concept of Inductance.

Maxwell's Equations: Faraday's Law, Continuity Equation, Inconsistency of Amperes Law, Differential and Integral Form of Four Maxwell's Equations, Boundary Conditions.

UNIT-III

Electromagnetic Waves – I: Concept of Electromagnetic Wave, Wave Propagation in Lossy Dielectrics, Wave Propagation in Lossless Dielectrics, Wave Propagation in Free Space, Wave Propagation in Good Conductors- Skin Depth, Concept of Polarization- Linear Polarization, Circular Polarization, Elliptical Polarization.

UNIT-IV

Electromagnetic Waves – II: Reflection of a Plane Wave at Normal Incidence (Dielectric-Dielectric & Dielectric-Conductor Interface), Reflection of a Plane Wave at Oblique Incidence (Parallel and Perpendicular Polarization) - Reflection Coefficient, Transmission Coefficient, Brewster Angle, Critical Angle; Surface Impedance, Poynting Theorem, Power Loss in a Plane Conductor.

UNIT-V

Transmission Lines: Types, Transmission line equations, Primary and Secondary Constants, Lossless, Distortion less, Low loss Transmission lines, Concept of Loading, Input Impedance relations, Reflection Coefficient, VSWR, Short Circuit and Open Circuit Lines, UHF Lines as Circuit elements, Matched Lines-$\lambda/4$, $\lambda/2$, $\lambda/8$ lines, Impedance Transformations, Infinite Line Concepts, Power in a Transmission line, Smith Chart, Quarter wave transformer, single stub matching and double stub matching, Microstrip lines-structure, effective dielectric constant, characteristic impedance.

TEXT BOOKS

1. Matthew N.O.Sadiku, "Elements of Engineering Electromagnetics", Oxford University Press, 4th Edition.
2. William Hayt, J A Buck, M JallelAkhtar "Engineering Electromagnetics", TMH Publishers, 8th Edition.

REFERENCE BOOKS

1. Jordan and Balmain, "Electromagnetic fields and Radiating systems", Pearson education.
2. K.Shevgaonkar, "Electromagnetic waves", TMH Publishers.

B.Tech. (IV-Sem.) **20MC02 – ENVIRONMENTAL SCIENCE**

L	T	P	Cr.
2	0	0	0

Prerequisite: Nil

Course Objectives:

In this course the student will learn about

- Environmental issues like over population, human health etc related to local, regional and global levels.
- The necessity of resources, their exploitation and sustainable management.
- The interactions of human and ecosystems and their role in the food web in the natural world.
- The global biodiversity, threats to biodiversity and its conservation.
- Environmental problems like pollution, disasters and possible solutions.
- The importance of environmental decision making in organizations through audits.

Course Outcomes: At the end of this course, the student will be able to

CO1: Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions. **(Remember– L1)**

CO2: Evaluate local, regional, and global environmental issues related to resources and their sustainable management **(Understand - L2)**

CO3: Realize the importance of ecosystem and biodiversity for maintaining ecological balance. **(Understand - L2)**

CO4: Acknowledge and prevent the problems related to pollution of air, water, and soil. **(Apply– L3)**

CO5: Identify the significance of implementing environmental laws and abatement devices for environmental management. **(Understand - L2)**

UNIT – I :Nature and scope of Environmental Problems

- Introduction to Environment Science.
- Population explosion, variations among nations
- Resettlement and Rehabilitation - Issues and possible solutions
- Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards.
- Role of Information Technology in environmental management and human health

UNIT – II :Natural Resources and Conservation

Introduction and classification of Natural Resources

- Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, conflicts over water, interlinking of rivers, dams-benefits and problems, Rainwater harvesting
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, soil salinity

- Energy resources: Growing energy needs renewable, non-renewable and alternate energy resources

UNIT – III :Ecology and Biodiversity

- Structure and functions of an Ecosystem, Food chains and Food webs, Ecological succession, Ecological pyramids, Biogeochemical cycles
- Biodiversity, Values of biodiversity, Bio geographical classification of India. Endangered and endemic species of India, Threats to biodiversity; Man and wild life conflicts, Conservation of biodiversity: In-situ and Ex-situ conservation methods

UNIT – IV : Environmental Pollution

Introduction to Environmental Pollution Causes, effects and control measures of:
Air pollution, Water pollution, Noise pollution, Solid Waste Management – Sources, Classification, effects and control measures of Municipal solid waste, Biomedical waste & Hazardous and e-waste, Disaster Management.

UNIT – V : Environmental Management

- Sustainable development and unsustainability
- Climate disruption, Greenhouse effect, Ozone layer depletion and Acid rain.
- Stockholm and Rio Summit
- Environmental Impact Assessment (EIA)
- Green building
- Environmental Law- Air, Water, Wildlife, Forest, and Environmental protection act

TEXTBOOKS:

1. Anubha Kaushik, C.P.Kaushik, "*Perspectives in Environmental Studies*", 5nd edition, New age international publishers, Delhi, 2016.
2. G. Tyler Miller, Scott Spoolman, *"Introduction to Environmental Studies"*, 13th Edition, Cengage Learning, New Delhi, 2009.

REFERENCE BOOKS:

1. M. Anji Reddy, "Textbook of Environmental Sciences and Technology", 2nd Edition, BS Publications, Delhi 2011.
2. Deeshita Dave, P. Udaya Bhaskar, "Environmental Studies", 2nd Edition, Cengage Learning, New Delhi, 2012.
3. S.Deswal, A. Deswal, "A Basic course in Environmental Studies", 2nd Edition, Educational & Technical Publishers, Delhi, 2014.
4. R. Rajagopalan, "Environmental Studies (From Crisis to Cure)", 3rd Edition, Oxford University Press, New Delhi, 2012.
5. De, A.K, "Environmental Chemistry", 5th Edition, New Age International (P) Limited, New Delhi, 2003.
6. Dr.K.V.S.G. Murali Krishna, "Environmental Studies", 1st Edition, VGS Techno Series, Vijayawada, 2010.
7. Mahua Basu, S.Xavier, "Fundamentals of Environmental Studies", 1st edition, Cambridge University Press, Delhi, 2016.

B.Tech. (IV-Sem.)	20AD53 – PROGRAMMING USING PYTHON LAB	L	T	P	Cr.
		1	0	2	2

Pre-requisite : Programming languages like C Language.

Course Educational Objective:

The Objective of Python course is to lead the students from the basics of writing and running Python scripts in problem solving and also to design and implement the modules and understands the working of classes and objects in python.

Course Outcomes (COs):*At the end of the course, the student shall be able to*

- **CO 1:** Identify various programming constructs available in Python and apply them in solving computational problems. (**Apply - L3)**
- **CO 2:** Demonstrate data structures available in Python and apply them in solving computational problems. (**Apply - L3**)
- **CO 3:** Implement modular programming, string manipulations and Python Libraries (**Apply - L3**)
- **CO 4:** Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example problems (Two weeks)

Implement Python Script for checking the given year is leap year or not.

Implement Python Script for finding biggest number among 3 numbers.

Implement Python Script for displaying reversal of a number.

Implement Python Script to check given number is Armstrong or not.

Implement Python Script to print sum of N natural numbers.

Implement Python Script to check given number is palindrome or not.

Implement Python script to print factorial of a number.

Implement Python Script to print all prime numbers within the given range.

Implement Python Script to calculate the series: S=1+x+x2+x3+.....xn

Implement Python Script to print the following pattern:

```
*
*   *
*   *   *
```

Module 1: Exercise Programs on Lists.

Write a Python script to display elements of list in reverse order.

Write a Python script to find the minimum and maximum elements without using built-in operations in the lists.

Write a Python script to remove duplicates from a list.

Write a Python script to append a list to the second list.

Write a Python script to count the number of strings in a list where the string length is 2 or more.

Module 2: Exercise Programs on Tuples.

Write a Python script to create a tuple with different data types.

Write a Python script to find the repeated items of a tuple.

Write a Python script to replace last value of tuples in a list.

Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]

Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]

Write a Python script to sort a tuple by its float element.

Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')]

Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]

Module 3: Exercise Programs on Sets.

Write a Python script to add member(s) in a set.

Write a Python script to perform Union, Intersection, difference and symmetric difference of given two sets.

Write a Python script to test whether every element in S is in T and every element in T is in S.

Module 4: Exercise Programs on Dictionaries

Write a Python script to sort (ascending and descending) a dictionary by value.

Write a Python script to check whether a given key already exists or not in a dictionary.

Write a Python script to concatenate following dictionaries to create a new one.

Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}

Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}

Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys.

Write a Python program to map two lists into a dictionary.

Module 5: Exercise Programs on functions and recursion.

a) Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.

b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.

c) Define functions to find mean, median, mode for the given numbers in a list.

d) Define a function which generates Fibonacci series up to n numbers.

e) Implement a python script for factorial of number by using recursion.

f) Implement a python script to find GCD of given two numbers using recursion.

Module 6: Exercise programs on Strings

a) Implement Python Script to perform various operations on string using string libraries.

b) Implement Python Script to check given string is palindrome or not.

c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.

d)Implement python script that takes a list of words and returns the length of the longest one.

Module 7: Exercise programs on Regular Expressions

a) Write a Python script to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).

b) Write a Python script to check whether password is valid or not.

Conditions for a valid password are:

Should have at least one number.

Should have at least one uppercase and one lowercase character.

Should have at least one special symbol.

Should be between 6 to 20 characters long.

Module 8 : Exercise programs on Matplotlib Library

a) Write a Python program to draw a line with suitable label in the x axis, y axis and a title.

b) Write a Python program to plot two or more lines with legends, different widths and colors.

c) Write a Python program to create multiple plots.

d) Write a Python programming to display a bar chart using different color for each bar.

e) Write a Python programming to create a pie chart with a title.

f)Write a Python program to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other.

****

B.Tech. (IV-Sem.)	20EC55 – DIGITAL SIGNAL PROCESSING LAB	L	T	P	Cr.
		0	0	3	1.5

Pre-Requisites: C – Programming, Basic Definitions of signals and systems.

Course Objectives: This course provides generation of basic signals and operations on signals. This course also provides design of IIR filters using Butterworth and Chebyshev approximation techniques and FIR filters using windowing techniques. This course also gives the knowledge about DSP Processors.

Course Outcomes (COs): At the end of the course, students are able to

CO1: Understand the generation and operations of signals using MATLAB.**(Understand – L2)**

CO2: Analyze the signals in time and frequency domains using MATLAB and Code Composer Studio.**(Analyze – L4)**

CO3: Construct IIR and FIR Filters and obtain their frequency response using MATLAB.**(Create – L6)**

CO4: Adapt effective communication, presentation skills and report writing.**(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	1
CO2	2	3	-	-	1	-	-	-	-	-	-	2	-	-	2
CO3	2	2	3	1	2	-	-	-	-	-	-	2	-	-	2
CO4	-	-	-	2	-	-	-	1	2	3		1	-	-	-

List of Experiments

Part I: Experiments using MATLAB Software

1. Generation of discrete time (DT) signals and operations on DT signals.
2. Linear Convolution.
3. Circular Convolution.
4. Computation of N-Point DFT and IDFT.
5. Linear and Circular convolution using DFT and IDFT.
6. Power Spectral Density for sinusoidal signal.
7. Design of Digital IIR butter worth filter using Bi-linear Transformation.
8. Design of Digital IIR Chebyshev filter using Bi-linear Transformation.
9. Design of FIR filters using window techniques.

Part II: Experiments using Code Composer Studio Simulation Soft ware and DSP Processors.

1. Linear Convolution.
2. Circular Convolution.
3. Computation of DFT.

B.Tech. (IV-Sem.) **20EC56 – ANALOG COMMUNICATIONS LAB**

L	T	P	Cr.
0	0	2	1

Pre-requisites: signals and systems.

Course Educational Objective: This course provides the practical exposure on analog communication schemes and gives the practical knowledge about pulse modulation techniques used in communication systems. It also gives the knowledge on implementation of analog and pulse modulation schemes using MATLAB.

Course Outcomes (COs): At the end of the course, students will be able to

CO1	Demonstrate the practical aspects of analog modulation schemes.**(Understand – L2)**
CO2	Construct the circuits that improve the performance of analog communication systems.**(Create – L6)**
CO3	Apply the programming aspects of MATLAB in simulation of continuous wave and pulse modulation techniques**(Apply – L3)**
CO4	Adapt effective communication, presentation and report writing skills.**(Apply – L3)**

Course Articulation Matrix (Correlation between COs & POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	1	-	-	-	-	-	-	-	2	-	-
CO2	2	3	1	-	1	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	-	-	1	2	3	-	1	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

Pre-requisites: signals and systems.

LIST OF EXPERIMENTS:

Part-A

1. Generate the Amplitude modulated (AM) signal for different modulation indices and reconstruct the original signal.
2. Demonstrate the generation of Frequency modulated signal and reconstruction of original signal.
3. Use product modulator to generate double sideband suppressed carrier AM signal and demodulate the signal using Synchronous detector.
4. Apply phase shift method for generating the Single sideband modulated AM signal and demodulate using coherent detector.
5. Estimate the cutoff frequencies for Pre emphasis and De-emphasis circuits.
6. Generate the Pulse Amplitude Modulated signal and reconstruct the original signal using low pass filter
7. Construct circuits for generating the Pulse width and Pulse position modulated signals using IC555 and perform demodulation to reconstruct the message signal
8. Generation of sampled signal for different sampling rates and verify sampling theorem for efficient reconstruction.

Part-B (Simulation Using MATLAB)

9. Amplitude Modulation and Demodulation.
10. Frequency Modulation and Demodulation.
11. Pulse Amplitude Modulation techniques.
12. Simulation of Pulse Time Modulation techniques.

20ECS2- MODELING, DESIGN AND PROTOTYPING

B.Tech. (IV-Sem.)

L	T	P	Cr.
1	0	2	2

PREREQUISITE: C-Programming, Pulse and Digital Circuits.

COURSE EDUCATIONAL OBJECTIVE(CEO):

In this course, student will learn about how to build an engineering application with LabVIEW software and associated hardware.

Course Outcomes (COs):At the end of this course, students will be able to

CO1: Understand the programming concept of virtual instruments.

CO2: Develop real time applications using loops, formula nodes, array, clusters and DAQ.

UNIT – I: LabVIEW Basics:

Virtual instrumentation-front panel, block diagram, data flow programming, Graphical programming, VI& Sub VIs, loops, shift register, feedback node, formula node, case and sequence structures, arrays, clusters.

UNIT – II: LabVIEW Advanced and DAQ

Waveform Graphs, waveform charts, files I/O, local and global variables, Data Acquisition in LabVIEW, DAQ Installation and Configuration, DAQ Assistant, DAQ Hardware.

TEXTBOOK:

1. S. Sumathi, P.Surekha, Virtual Instrumentation with LabVIEW, ACME Learning Pvt Ltd.,2007.
2. Jeffrey Travis, Jimkring, LabVIEW for Everyone, Pearson Education, 2009.

REFERENCES:

1. Jovitha Jerome, Virtual Instrumentation using LabVIEW, PHI Learning Pvt. Ltd., 2006.
2. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki – LabVIEW Advanced Programming Techniques, CRC Press, 2009.

HANDS – ON LABORATORY SESSIONS

1. VI and Data operations
2. For and While Loops
3. Buttons, Timers and Graphs
4. Flat Sequence & Case Structure Applications
5. Arrays and Clusters
6. Sub VIs and Formula nodes
7. File operations
8. DAQ Installation and Configuration
9. DAQ- Digital applications
10. DAQ- Analog applications