Course Title	**Engineering Mathematics – III**			
Course Code	**BSEC-101**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 70%-80%

Course Outcomes

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

CO	Definition
C01	Understand the use of Laplace transforms to solve differential equations and improper integrals.
C02	Identify the complex functions and separate real and imaginary parts of a complex function
CO3	Compute complex line integrals using the concept of analytic
CO4	Analyze the concept of vector spaces and its sub-spaces.
CO5	Apply partial differential techniques to solve the physical engineering problems.
CO6	Demonstrate a firm understanding of the solution techniques for Linear ordinary differential equations of second order.

Syllabus: **[Total Contact Hours: 39]**

Part A

Unit I: Laplace Transforms: **[6]**

Laplace transform of various standard functions , properties of laplace transforms, inverse laplace transforms, transforms of derivatives and integrals, applications to solutions of ordinary linear differential equations with constant cofficients

Unit II: Complex Functions: **[8]**

Modulus amplitude form of a complex no., De-moivre's theorem and its basic questions, finding roots of a complex number, Real and imaginary parts of exponential , logarithmic, circular and hyperbolic functions of complex variables.

Unit III: Linear Algebra and Complex Analysis **[9]**

Vector spaces, Subspaces, basis, Dimension, Analytic functions, Line integral, Cauchy integral theorem and formula, Taylor and Laurent Series (without Proof), Residue theorem and Application, Bilinear transformation.

Part B

Unit IV: Partial Differential Equations and its applications **[9]**

Formation of Partial differential equations, Equations solvable by direct integration, First order linear partial differential equations, homogeneous partial differential equations with constant coefficients, classification of linear second order partial differential equations, Wave equation in one dimension, Laplace equation.

Unit V: Special Functions **[7]**

Frobenius Method, Legendre and Bessel functions, Bessel functions of first and second kind, Recurrence relations.

Text Books:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics III",Laxmi Publications.

Recommended Books and References:

1. C. W. Curits, "Linear Algebra: An Introductory Approach", Springer.
2. A. D. Belegunder, T. R. Chandrupatla, "Optimization Concepts and Application in Engineering", Pearson Education Asia.
3. Ian Sneddon, "Elements of Partial Differential Equations", McGraw-Hill.
4. Rule V. Churchle, James Ward Brown, "Complex Variable and its Applications", McGraw Hills.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill,New Delhi, 11th Reprint,2008
6. Erwin Kreyszig, Advanced Engineering Mathematics, 9thEdition ,John Wiley & sons, 2006

E-Book and other online study material:

1. https://lecturenotes.in/subject/19/mathematics-3-m-3
2. file:///C:/Users/COMP%20LAB/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/EngineeringMathematics_by_H.D.Block_Vol1.pdf

MOOCS and videos course:

1. https://www.youtube.com/watch?v=P7gVp333B6M&list=PLC183993246C4F397
2. https://www.youtube.com/watch?v=Pu3tEorDyes&list=PLm_MSClsnwm8GcUuLM5ER3VD0UEZqBWcv

Course Title	**Electronic Devices**			
Course Code	**PCEC-101**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Course Outcomes

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

CO	Definition
CO1	Apply the basic mechanism of semiconductors in various types of diodes, bipolar junction transistors and field effect transistors.
CO2	Analyze the behavior of different electronic components in terms of V-I characteristics.
CO3	Select suitable techniques to provide stabilization in electronic circuits against external factors like temperature and component variations.
CO4	Design solutions for problems pertaining to electronic circuits under given operating conditions and specifications.
CO5	Comprehend the operation of low and high frequency transistor models.
CO6	Illustrate the applications of electronic circuits by inspecting the function of each discrete electronic component.

Syllabus: **[Total Contact Hours: 39]**

Part A

Unit 1: Introduction **[6]**

Energy bands in silicon, intrinsic and extrinsic silicon, carrier transport in silicon: diffusion current, drift current, mobility, and resistivity, generation and recombination of carriers.

Unit 2: Diode Circuits **[8]**

Theory of PN junction diode, volt ampere characteristics, band structure of open circuited PN junction, small signal equivalent circuit of diode, temperature dependence of PN diode, rectifiers, filter circuits, special purpose diodes: zener diode as voltage regulator, tunnel diode, LED, LCD and photodiodes.

Unit 3: Transistor Biasing and Stabilization **[9]**

PNP & NPN transistor, construction and characteristics in CB, CE and CC modes, transistor as an amplifier, transistor series and shunt regulators, UJT, photo-transistors, operating point, bias stability, various biasing circuits, stabilization against I_{CO}, V_{BE} and beta, bias compensation methods, thermal resistance.

Part B

Unit 4: Field Effect Transistors **[6]**

Construction and characteristics of junction field effect transistor (JFET), MOSFETs: Enhancement and depletion type, FET parameters, Biasing of FETs, applications of FETs, MOS capacitor.

Unit 5: Low Frequency and High Frequency Transistor Models [10]

h-parameter equivalent circuit of transistor, analysis of transistor amplifier using h-parameters in CB, CE and CC configuration, frequency response of amplifier, effect of an emitter bypass capacitor, coupling capacitor, emitter resistance and shunt capacitors on frequency response of amplifier, High frequency T model, common base short circuit current frequency response, alpha cutoff frequency, common emitter short circuit current frequency response, hybrid pi CE transistor model, hybrid pi conductance in terms of low frequency h parameters.

Text Books:

1. J. Millman, C., C. Halkias, "Electronic Devices & Circuits", Tata McGraw Hill.
2. R. L. Boylestad, "Electronic Devices & Circuits Theory", Prentice Hall India.

Reference books and other resources:

1. A. Mottorshead, "Electronic Devices & Circuits", Prentice Hall India.
2. A. Malvino, D. J. Bates, "Electronics Principles", Tata McGraw Hill, 2007.
3. J. Millman, C. C. Halkias, "Integrated Electronics: Analog & Digital Circuits and Systems", Tata McGraw Hill.

E-Books and online learning material

1. Basic Electronics
http://engineering.nyu.edu/gk12/amps-cbri/pdf/Basic%20Electronics.pdf Accessed on Feb. 28, 2019
2. Electronic Devices & Circuits by J. Millman, C. C. Halkias
https://archive.org/details/ElectronicDevicesCircuits/page/, Accessed on Feb. 28, 2019
3. Electronic Devices and Circuits Notes (EDC)
https://www.smartzworld.com/notes/electronic-devices-and-circuits-edc/, Accessed on Feb. 28, 2019
4. Electronic devices and circuits By Salivahanan
https://www.scribd.com/doc/130840933/Electronic-devices-and-circuits-By-Salivahanan-pdf, Accessed on Feb. 28, 2019
5. Introduction to Electronics by Y.N. Singh
https://nptel.ac.in/courses/122104013/main1.html, Accessed on Feb. 28, 2019

Online Courses and Video Lectures

1. https://www.nptel.ac.in/courses/117103063/, Accessed on Feb. 28, 2019
2. https://nptel.ac.in/courses/117106091/, Accessed on Feb. 28, 2019
3.http://www.nptelvideos.in/2012/11/basic-electronics-prof-tsnatarajan.html, Accessed on Feb. 28, 2019
4. https://www.youtube.com/watch?v=PSdHf6yozyc, Accessed on Feb. 28, 2019

Course Title	**Network Analysis and Synthesis**			
Course Code	**PCEC-102**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**

Numerical & Design Problems Content: 30%-40%

Course Outcomes

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

CO	Definition
CO1	Comprehend different types of signals used in electrical systems
CO2	Analyze the circuits using various network theorems
CO3	Analyze the transient and steady state response of networks using Laplace transforms
CO4	Synthesize two terminal networks
CO5	Design basic cut set and tie set matrices for planar networks.
CO6	Formulate and design filter networks for different systems

Syllabus: **[Total Contact Hours: 39+13(T) = 52]**

Part A

Unit 1. Circuit Concepts **[9+2(T) =11]**

Independent and dependent sources, signals and wave forms, periodic and singularity voltages, step, ramp, impulse, doublet, loop currents and loop equations, node voltage and node equations, network theorems, superposition, Thevenin's, Norton's, maximum power transfer, and reciprocity.

Unit 2. Time and Frequency Domain Analysis **[8+3(T) =11]**

Representation of basic circuits in terms of generalized frequency and their response, Laplace transform of shifted functions, transient and steady response, time domain behaviors from poles and zeros, convolution theorem

Part B

Unit 3. Network Synthesis **[10+4(T) =14]**

Network functions, impedance and admittance function, transfer functions, relationship between transfer and impulse response, poles and zeros and restrictions, network function for two terminal pair network, sinusoidal network in terms of poles and zeros, real liability condition for impedance synthesis of RL and RC circuits, network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit 4. Filters **[8+3(T) =11]**

Classification of filters, characteristics impedance and propagation constant of pure reactive network, ladder network, T-section, π-section, terminating half section, pass bands and stop bands, design of constant-K, m-derived filters, composite filters.

Unit5. Network Topology **[4+1(T) =5]**

Definitions, graph, tree, twigs, basic cut-set and basic tie set matrices for planar network.

Text Books:

1. A. Chakraborty, “Circuit Theory”, DhanpatRai.
2. A. Sudhakar, Shyammohan S. Pali, “Circuits and Networks: Analysis and Synthesis”, Tata McGraw Hill.

Reference books and other resources:

1. J. Bird, “Electrical Circuit Theory and Technology”, Newnes.
2. D. Roy Chaudhury, “Networks and Synthesis”, New Age International.
3. M. Nahvi, J. A. Edminister, “Electric Circuits (Schaum’s outline series)”, Tata McGraw Hill.
4. T. S. K. V. Iyer, “Circuit Theory”, Tata McGraw Hill.
5. M. E. Van Valkenberg, “Network Analysis and Synthesis”, PHI Learning.

E books and online learning materials.

1. https://bookstackweb.files.wordpress.com/2017/07/alexander-sadiku-fundamentals-of-electric-circuits.pdf
2. https://archive.org/details/NetworkAnalysisSynthesis

MOOCS and Video Course.

1. https://www.youtube.com/watch?v=UMhBgyK8F0U&list=PLByCtUEqH47zpwbHOog_UIItHmtMIT0FO
2. https://www.youtube.com/watch?v=5Zw8776D04A&list=PL-DyDJ8dpGDOZjYPFBL214EcvYBfE4tSW

Course Title	**Signals and Systems**			
Course Code	**PCEC-103**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**

Numerical & Design Problems Content: 50%-60%

Course Outcomes

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

CO	Definition
CO1	Apply various operations on the signals and classify continuous and discrete time signals and systems.
CO2	Make use of Fourier series and Fourier transform tools for the analysis of continuous and discrete time signals.
CO3	Analyze various techniques to classify LTI systems and develop solutions for mathematical representation of systems.
CO4	Predict the behavior of random signals using probability theory.
CO5	Examine the effect of noise sources on system performance.
CO6	Test real-time systems using self-study and engage in life-long learning.

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Part A

Unit 1. Classification of Signals and Systems [11+3(T)=14]

Introduction, Elementary signals in continuous and discrete domain, Operations on Signals: scaling, shifting and folding. Classification of Continuous-time and Discrete-timesignals, Classification of Continuous-time and Discrete-time systems.

Unit 2. Analysis of Continuous-time and Discrete-time signals [12+3(T)=15]

Representation of Continuous-time and discrete-time signals using Fourier series: Trigonometric Fourier series, Polar Form of Fourier series and Exponential Fourier Series, concept of negative frequency, Properties of Fourier Series, Aperiodic Continuous-time and discrete-time signal representation using Fourier Transform, Properties of Fourier Transform, Fourier Transform of Periodic Power Signals, Power Spectral Density, Energy Spectral Density, Parseval's Theorem and correlation.

Part B

Unit 3. Continuous-Time Linear Time Invariant Systems [5+2(T)=7]

Definitions and Properties of LTI Systems, Impulse and step response, Convolution integral, Transfer function.

Unit 4. Random Signal Theory [6+2(T)=8]

Introduction to Probability Theory, Definitions, Probability of Random Events, Joint and Conditional Probability, Probability Mass Function, Probability Density Function, Statistical Averages, Examples of Probability Density Functions, Transformation of Random Variables, Random Process: Stationary and Non-stationary, Ergodicity.

Unit 5. Signal Transmission through Systems [5+3(T)=8]

Sampling Theorem, Thermal Noise, Shot noise, Partition noise, Flicker noise, Gaussian Noise, Noise in Bipolar Junction Transistors (BJTs), FET noise. Equivalent input noise,

Signal to Noise Ratio (SNR), Noise Temperature, Noise equivalent Bandwidth, Noise Figure, Experimental determination of Noise Figure, Matched Filter.

Text Books:

1. S. Haykins and B. V. Veen, "Signals and Systems", John Wiley & Sons, 2nd Edition, 2008.
2. S. Haykin, "Communication Systems", John Wiley & Sons, 3rd Edition, 2008.

Reference books:

1. H. P. Hsu, "Signals and Systems", McGraw Hill Education Pvt. Ltd., 2nd Edition, 2008.
2. A. V. Oppenheim, S. Wilsky and S. H. Nawab, "Signals and Systems", Pearson Education, 2007.
3. M. J. Roberts, "Signals and Systems: Analysis using Transform Methods and MATLAB", Tata McGraw-Hill, 2nd Edition, 2012.
4. D. Sundararajan, "A Practical Approach to Signals and Systems", John Wiley & Sons, 2008.
5. S. Ghosh, "Signals and Systems", Pearson Education, 2006.
6. W.V. Etten, "Introduction to Random Signals and Noise", John Wiley & Sons, 2005.

E books and online learning materials:

1. http://www.di.univr.it/documenti/OccorrenzaIns/matdid/matdid744681.pdf
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-notes/

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117104074/1
2. http://nptel.ac.in/courses/117104074/2

Course Title	**Digital Electronics**			
Course Code	**PCEC-104**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**

Numerical & Design Problems Content: 40-50%

Course Outcomes

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

CO	Definition
CO1	Apply the knowledge of number systems, codes, minimization techniques like Boolean Algebra, K-Map and Q.M. method to analyze and design digital circuits.
CO2	Identity, formulates, and solves engineering problems in the area of digital electronics.
CO3	Apply appropriate techniques to design digital circuits with minimum hardware components to meet the desired application within realistic constraints.
CO4	Identify and use the appropriate type of analog to digital converters and digital to analog converters for the specified design problems.
CO5	Apply domain knowledge to select the relevant semiconductor memories to meet the design specifications.
CO6	Apply reasoning informed by the contextual knowledge to assess the merit and demerits of different logic families for optimal and sustainable circuit design.

Syllabus: **[Total Contact Hours: 39+13(T) =52]**

Part A

Unit 1. Number Systems and Binary Codes [8+3=11]

Introduction, Binary, Octal and hexadecimal number system. Binary operations– addition, Subtraction, Multiplication and division, Signed binary numbers, Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Gray code, Octal code, BCD code and BCD additions.

Unit 2. Minimization of Logic Function [8+2=10]

Logic Gates:OR, AND, NOT, NOR, NAND, EX-OR, Pin diagram and description of ICs of logic gates, Boolean algebra, Basic theorem of Boolean algebra, Minimization using Boolean algebra, Standard representations of logic functions, K-map representation of Logic Functions, Minimization using K-map and Q-M method, Incompletely specified functions/Don't care Conditions.

Unit 3. Combinational Logic Circuits [7+2=9]

Introduction, Combinational circuit design, multiplexer, Implementation of Combinational circuit using multiplexer, Demultiplexer, Use of demultiplexer in combinational logic design, Adders, Subtractors, use of adders as subtractors, Adder with look-ahead carry, Encoder, Decoder, Code converters, Parity generator/checker, digital comparators, BCD to 7 segment display decoder/driver, Pin diagram and description of ICs (74150, 74154, 7483, 74147, 74148, 7442, 74184, 74180, 7485, 7447).

Part B

Unit 4. Sequential Circuits **[7+3=10]**

Introduction, Flip-flops, Flip-flop types, Applications of Flip-flops, Shift Registers. Types of Shift Registers, circuit diagram, timing wave form and applications, Counters, counter types, counter design with state equation and state diagrams, Pin diagram and description of ICs of Flip-flops, Shift Registers, and Counters.

Unit 5. D/A and A/D Converters **[5+2=7]**

Introduction, Digital to Analog Converters (DACs), Types and Specifications of DACs, Analog to Digital Converters (ADCs), Types and Specifications of ADCs.

Unit 6. Digital Logic Families **[4+1=5]**

Characteristics of Digital ICs, RTL, DCTL, DTL, TTL, ECL, CMOS logic families and their types, Comparison of these logic families.

Text Books:

1. R. P. Jain, Modern Digital Electronics, Tata McGraw–Hill Education Pvt. Limited, New Delhi.
2. Thomas L. Floyd, Digital Fundamentals, Pearson Education, New Delhi, 2003.

Reference books:

1. Morris Mano, Digital Design, Prentice Hall of India Pvt. Ltd
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital System-Principles and Applications, Pearson Education.

E books and online learning materials:

1. https://www.nodia.co.in/image/catalog/2015/08/Digital-Electronics-sample-chapter.pd
2. https://www.cl.cam.ac.uk/teaching/0708/DigElec/Digital_Electronics_pdf.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106086/3
2. http://nptel.ac.in/courses/117106086/7

Course Title	**Computer Architecture**			
Course Code	**PCEC-105**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 20%-30%

Course Outcomes

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

CO	Definition
CO1	Able to describe the structure and functioning of a digital computer, operating system and digital components.
CO2	Able to explain the generic principles that underlie the building of digital computer, digital logic and processor programming.
CO3	Comprehend the architecture and organization of computers
CO4	Describe the memory organizations in a computer system
CO5	Explain the concept of sequencing and memory management in an operating system.
CO6	Discuss the hardware and software performance issues in a multi-core organization

Syllabus: **[Total Contact Hours:39]**

Part A

Unit 1. Introduction [9]

Organization and Architecture, Structure and Function, Brief history of Computers, Designing for performance, Performance metrics: MIPS, MFLOPS, Computer Components and Functions, Interconnection Structures, Bus Interconnection, Point-to-Point Interconnect, PCI Express, Flynn's classification of Computers (SISD, MISD, MIMD), Error Detection and Correction.

Unit 2. Internal and Cache Memory [8]

Computer Memory System Overview, Cache Memory Principles, Elements of Cache Design, Pentium 4 Cache Organization, Semiconductor Main Memory, Advanced Drum Organization

Part B

Unit 3. Basic non Pipeline CPU Architecture and Operating System [9]

CPU Architecture, types (accumulator, register, stack, memory/register) detailed data path of a typical register based CPU, Fetch-Decode-Execute cycle (typically 3-5 stage), microinstruction sequencing, implementation of control unit, Enhancing performance with pipelining, Operating system overview, Scheduling, Memory Management, Pentium Memory Management, RISC v/s CISC.

Unit 4. Parallel Processing and Multi-Core computer [8]

Multiple Processor Organizations, Symmetric Multiprocessors, Cache Coherence and the MESI protocol, Multithreading and Chip Multiprocessors, Clusters, Non-Uniform Memory Access, Vector Computation, Multi-Core Computers, Hardware and Software Performance Issues, Multi-Core Organization, Intelx86 Multi-Core Organization

Unit 5. Semiconductor Memories **[5]**

Introduction, Memory organization and Operation, Classification and characteristics of memories, Read-only memory, Read-Write memory, Content addressable memory, Charged coupled device memory.

Text Books:

William Stallings, Computer Organization and Architecture, 9/E Pearson, Delhi.

Reference Books:

Computer Architecture and Organization, 3rd Edition, John P. Hayes, 1998, TMH.

E books and online learning materials:

1. http://www.cse.iitm.ac.in/~vplab/courses/comp_org/LEC_INTRO.pdf
2. http://nptel.ac.in/courses/106103068/pdf/coa.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/106103068/1
2. http://nptel.ac.in/courses/106103068/5

Course Title	**Environmental Science**			
Course Code	**MCEC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**2**	**0**	**0**

Course Outcomes:

CO#	Course Outcomes (CO)
1	Measure environmental variables and interpret results.
2	Evaluate local, regional and global environmental topics related to resource use and management.
3	Propose solutions to environmental problems related to resource use and management.
4	Interpret the results of scientific studies of environmental problems.
5	Analyze the affects of economic development on the society.
6	Describe the implication of e-waste on environment and its potential solutions.

Syllabus: **[Total Contact Hours:26]**

Part-A

Unit I: Natural Resources: **[4]**

Renewable and non renewable resources: Natural resources and associated problems: Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people.

Unit II: Water resources: **[5]**

Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems, Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers-pesticides problems, water logging, salinity, case studies, Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies, Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.

Unit III:Eco Systems: **[4]**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers, decomposers, Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystems: Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Part-B

Unit IV:Environmental Pollution: **[5]**

Definition, causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies.

Unit V:Social issues and the Environment: **[5]**

Form unsustainable to sustainable development, Sustainable development goals by united nations, Water conservation, rain water harvesting, water shed management, Resettlement and rehabilitation of people; its problems and concerns, case studies, Environmental ethics: issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies, Introduction to various acts related to air pollution control, water pollution control and forest conservation.

Unit VI: e-waste Management: **[3]**

Meaning of e-waste, composition of e-waste and its generation, pollutants from e-waste, impact of e-waste on humans and environment, different approaches for collection and management of e-waste, e-waste management guidelines of government of India.

Text Books

1. Textbook of Environmental studies, ErachBharucha, UGC
2. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd
3. Principle of Environment Science by Cunninghan, W.P.
4. Electronic Waste Management Design, Analysis and Application by R E Hester and R M Harrison.

Reference Books

1. Perspectives in Environmental Studies by Kaushik, A.
2. Elements of Environment Science & Engineering by Meenakshi.
3. Essentials of Environment Science by Joseph.

E-Books and online learning material

1. Weblink: https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

2.Weblink:http://www.moef.gov.in/sites/default/files/EWM%20Rules%202016%20english%2023.03.2016.pdf(Electronic Waste Management Rules, 2016, Govt. of India)

Course Title	**Electronic Devices - Lab**			
Course Code	**LPCEC-101**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition
CO1	Examine the role of active and passive electronic components for different applications like rectification, filtering and amplification.
CO2	Assess the behavior of special purpose zener diode and photodiode.
CO3	Demonstrate the current-voltage characteristics of bipolar junction transistor and field effect transistor in different mode.
CO4	Conduct experiments to deduce the stability of various transistor biasing circuits.
CO5	Distinguish the response of electronic circuits for given specifications.
CO6	Work as an individual or in a team to demonstrate the applications of electronic components.

Syllabus:

Experiment 1. To perform the operation of half wave rectifier.
Experiment 2. To perform full wave & bridge rectifier and calculate efficiency and ripple factor.
Experiment 3. To study simple capacitive, T & π filters.
Experiment 4. To observe the application of Zener diode as voltage regulator.
Experiment 5. To implement any one application of photodiode.
Experiment 6. To plot the input and output characteristics of CE configuration.
Experiment 7. To plot the input and output characteristics of CB configuration.
Experiment 8. To determine h- parameters of a transistor using output characteristics.
Experiment 9. To design fixed bias circuit.
Experiment 10. To design potential divider transistor biasing circuit.
Experiment 11. To observe the operation of an emitter follower circuit.
Experiment 12. To plot JFET characteristics in CS configuration.

Reference Books and Other Resources:

Lab manuals available in lab.

Course Title	**Digital Electronics – Lab**			
Course Code	**LPCEC-102**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

NOTE: Do all Experiments.Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition
CO1	Demonstrate operation of basic and universal gates.
CO2	Design and verify the standard combinational circuits.
CO3	Analyse and verify the operation of different types of Flip-Flops.
CO4	Verify the working of shift registers.
CO5	Apply the knowledge to Design counters using Flip-Flops for given count sequence.
CO6	Work in a team to demonstrate applications of digital circuits by engaging in self-learning.

Syllabus:

Experiment 1. To verify the truth-tables of OR, AND, NOT, XOR, NAND and NOR logic gates.

Experiment 2. To realize the OR, AND, NOT and XOR functions using universal gates.

Experiment 3. To realize the Half Adder and Full Adder circuits using logic gates.

Experiment 4. To realize the Half Subtractor and Full Subtractor using logic gates.

Experiment 5. To design 4-Bit Binary-to-Gray Code Converter using logic gates.

Experiment 6. To verify the truth-table of 16:1 Multiplexer and 1:16 Demultiplexer.

Experiment 7. To design and test S-R flip-flop using NAND/NOR gates.

Experiment 8. To verify the truth-tables of J-K, D, and T flip-flops.

Experiment 9. To realize SIPO, SISO, PIPO, and PISO shift register circuits using D flip-flops.

Experiment 10. To design MOD-10 synchronous up-counter using D flip-flops.

Experiment 11. To operate the counters (using ICs 7490/7493/74192) and verify the frequency division at each stage. With a low frequency clock (say 1 Hz) display the count on LEDs.

Experiment 12. To study shift-register operations using IC 7495 chip.

Experiment 13. To verify the truth table of decoder driver 7447/7448 and operate a 7-segment LED/LCD display.

Reference Books and Other Resources:

Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117106086/17
2. http://nptel.ac.in/courses/117106086/21

Course Title	**Analog Circuits**			
Course Code	**PCEC-106**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**

Numerical & Design Problems Content: 30%-40%

Course Outcomes

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

CO	Definition
CO1	Comprehend the operation of amplifiers on the basis of different coupling techniques and feedback topologies.
CO2	Analyze the behavior of different large signal amplifiers and oscillators.
CO3	Interpret the characteristics and performance parameters of operational amplifier and use it for various linear and non-linear applications.
CO4	Design circuits like integrator, differentiator and active filters satisfying desired needs within realistic constraints.
CO5	Describe the working principle of multivibrators and voltage regulators using application specific ICs.
CO6	Engage in self-study to demonstrate applications of electronic circuits.

Syllabus: **[Total Contact Hours: 39+13(T)=52]**

Part A

Unit 1: Multistage Amplifiers **[6+2=8]**

Coupling of transistor amplifiers, frequency response of coupled amplifiers, Types of coupling: RC coupling, Transformer coupling, direct coupling, Cascode amplifier, Darlington amplifier. Tuned Amplifiers: single tuned, double tuned and stagger tuned amplifiers.

Unit 2: Large Signal Amplifiers **[6+2=8]**

Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, push-pull amplifiers, operation of Class A push-pull amplifier, Class B push-pull amplifier, crossover distortion, Class AB push-pull amplifier, Transistor phase inverter, Complementary-symmetry amplifier.

Unit 3: Feedback in Amplifiers **[6+2=8]**

Types of feedback, effect of negative feedback on gain, input impedance, output impedance, bandwidth, stability, distortion and frequency response, voltage series, current series, voltage shunt, current shunt feedback circuits and their analysis.

Unit 4: Oscillators **[4+1=5]**

Sinusoidal oscillators, Criterion for oscillation, Different types of oscillators: RC Phase Shift, Wien Bridge, Hartley, Colpitt, Crystal Oscillators and Derivation of frequency for these oscillators.

Part B

Unit 5: Op-Amp Theory [8+3=11]

Introduction, Differential Amplifier- Basic Circuit and its operation, Differential Amplifier circuit configurations- their dc analysis, Current mirror circuit, Block diagram of an Op-Amp, schematic symbol, Ideal Op-amp and its characteristics, Ideal voltage transfer characteristics, performance parameters of an Op-Amp, Input bias current, input offset current, output offset voltage, differential gain, common mode gain, CMRR,SVRR.

Unit 6: Applications of Op-Amp [9+3=12]

Basic configuration of Op-Amp-Differential, Inverting & Non-inverting, Integrator, differentiator, summing amplifier, Basic comparator, Zero crossing detector, Schmitt trigger, Active filters: Low pass, High pass, Band pass and Band stop, Square wave generator, Triangular wave generator, IC 555 timer : Block diagram and its operation, IC 555 as a monostable multivibrator, voltage regulators: fixed, adjustable and switching.

Text Books:

1. J. Millman, C. Halkias and C. D. Parikh, "Integrated Electronics: Analog and Digital Circuits and Systems", McGraw Hill Education, 2nd Edition, 2010.
2. R. Boylested and L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice Hall of India, 10th Edition, 2009.
3. R. Gayakwad, "Op-Amp and Linear Integrated Circuits", Pearson prentice hall.

Reference books:

1. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2011.
2. A. Malvino and D. J. Bates, "Electronic Principles", Tata McGraw-Hill, 7th Edition, 2007.
3. T. L. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.
4. J. Millman, C. C. Halkias and S. Jit, "Electronic Devices and Circuits", Tata McGraw-Hill, 3rd Edition, 2010.
5. R.F Coughlin and F.F Driscoll, "Operational Amplifier and Linear Integrated Circuits", Prentice Hall.
6. Malvino, "Electronic principles", Tata McGraw-Hill Publications.

E books and online learning materials:

1. https://lecturenotes.in/subject/429/electronic-devices-and-circuits-edc
2. https://hristotrifonov.files.wordpress.com/2012/10/electronic-devices-9th-edition-by-floyd.pdf
3. https://www2.mvcc.edu/users/faculty/jfiore/OpAmps/OperationalAmplifiersAndLinearICs_3E.pdf
4. https://www.scribd.com/document/356463964/Linear-Integrated-Circuit-2nd-Edition-D-Roy-Choudhary-pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117103063/20
2. http://nptel.ac.in/courses/117103063/33
3. http://nptel.ac.in/courses/108106068/4
4. http://nptel.ac.in/courses/108106068/10

Course Title	**Object Oriented Programming using C++ and Data Structures**			
Course Code	**PCEC-107**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 50%-60%

Course Outcomes

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

CO	Definition
CO1	Demonstrate the basic concepts of object-oriented programming and comprehend encapsulation.
CO2	Apply the knowledge of C++ to access data through pointers and understand memory allocation.
CO3	Illustrate how to apply the major object-oriented concepts to implement inheritance and polymorphism.
CO4	Identify the need of constructor and destructor to implement features of object-oriented programming.
CO5	Understand advanced features of C++ specifically templates, exception handling and operator overloading.
CO6	Explain fundamentals of data structures and distinguish various data structures according to their use and implementation.

Syllabus: **[Total Contact Hours: 39]**

Part A

Unit 1. Principles of Objected Oriented Programming [7]

Basic concepts of object-oriented programming-data types, variables, strings, functions, arrays, structures, standard input/output, features of object-oriented programming, classes and objects.

Unit 2. Pointers and Dynamic Memory Management [5]

Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit 3. Inheritance and Polymorphism [7]

Types of inheritance, base classes and derived classes, public, private and protected inheritance, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors, virtual functions and polymorphism, dynamic binding, pure virtual functions, abstract base classes.

Part B

Unit 4. Constructors and Destructors [6]

Need for constructors and destructors, copy constructor, constructors and destructors in derived classes, constructors and destructors with static members, virtual destructors, initializer lists, operator overloading and type conversion.

Unit 5. Exception Handling and Templates **[3]**
Exception handling, templates and generic programming.

Unit 6. Introduction to Data Structures **[3]**
Introduction to data structures, introduction to algorithms complexity.

Unit 7. Arrays, Stacks & Queues **[8]**
Concepts; basic operations & their algorithms: transverse, insert, delete, sorting of data in these data structures, prefix, infix, postfix notations.

Text Books:

1. E. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 3rd edition,2007.
2. Ashok N.Kamthane, "Object Oriented Programming with ANSI & Turbo C++",Pearson education, Fourth impression, 2008.
3. B. Stroustrup, "The C++ Programming Language", Addison Wesley, Reading Mass, USA, 4th Edition, May 2013.
4. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw-Hill, Special Indian edition, 2006.

Reference books and other resources:

1. Lafore R., "Object Oriented Programming in C++", Indianapolis, Ind. :Sams Publ., 4th edition, 2005.
2. *Michael Goodrich*, Roberto Tamassia& David Mount "*Data structures* and *algorithms* in *C++", Copyright © 2004* by John *Wiley*& Sons, 2010.

E books and online learning materials.

1. http://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf
2. https://archive.org/details/EBalagurusamyObjectOrientedProgrammingWithC

MOOCS and Video Course.

1. https://www.youtube.com/watch?v=WpJ_yiwbGyk&list=PL3wYxbt4yCi5WymYaVLSpCto_LNbVNNA
2. https://www.youtube.com/watch?v=xnh7ip5gpzc&list=PLfVsf4Bjg79DLA5K3GLbIwf3baNVFO2Lq

Course Title	**Electromagnetic Field Theory**			
Course Code	**PCEC-108**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 30%-40%

Course Outcomes

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

CO	Definition
C01	Apply the Maxwell's equations to solve boundary conditions in different media
C02	Demonstrate the concept of electromagnetic wave propagation and its sinusoidal variation in different media
CO3	Analyze the characteristics of guided waves in parallel planes
CO4	Explain the propagation of waves in rectangular and circular waveguides
CO5	Describe and analyze parallel plane transmission lines with Smith charts
CO6	Use knowledge of waveguides and transmission lines to design communication mediums.

Syllabus: **[Total Contact Hours: 39]**

Part A

Unit 1. Introduction to Time varying fields **[4]**

Maxwell's equations in differential and integral forms, Concept of displacement current and conduction current, Boundary conditions.

Unit 2.Electromagnetic Waves **[9]**

Wave equation and its solution in different media, Plane wave, Sinusoidal time variations, Polarization, Reflection of waves by perfect dielectrics and by perfect insulators, Surface impedance, Poynting theorem and Poynting vector.

Unit 3. Guided Waves **[9]**

Waves between parallel planes, TE, TM waves and their characteristics, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance.

Part B

Unit 4. Wave Guides **[9]**

Rectangular and circular wave guides, TE and TM waves in rectangular waveguides, Impossibility of TEM wave in wave guides, Wave impedance and Characteristic impedance, Transmission line analogy for wave guides, Attenuation factor of wave guides.

Unit 5. Transmission Lines **[8]**

Circuit representation of parallel plane transmission lines, Parallel plane transmission line with losses, Lossless line, Low loss RF and UHF transmission lines, Distortionless line, Transmission line charts-impedance matching.

Text Books:

1. E. C. Jordan & K. G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition , PHI, 2011.
2. P. V. Gupta,Introductory Course In Electromagnetic Fields, 3rd edition, Dhanpat Rai & Sons Company Limited.

Reference Books / Study material:

1. W. H. Hayt& J.A. Buck, Engineering Electromagnetics, 8th edition, TATA McGraw-Hill, 2014.
2. W. H. Hayt& J.A. Buck, Problem and solutions in Electromagnetics, 8th edition TATAMcGraw-Hill, 2014.
3. John Krauss, Electromagnetics and applications, 4th edition, Tata McGraw-Hill, 2010.
4. Matthew, N. O. Sadiku, Elements of Engineering Electromagnetics, 4th edition, Oxford University Press, 2007.

E books and online learning materials:

1. https://www.calvin.edu/~pribeiro/courses/engr315/EMFT_Book.pdf
2. https://www.photonics.ethz.ch/fileadmin/user_upload/Courses/EM_FieldsAndWaves/Intro.pdf

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108106073/3
2. http://nptel.ac.in/courses/108106073/5

Course Title	**Linear Control Systems**			
Course Code	**PCEC-109**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**1**	**0**

Numerical & Design Problems Content: 50%-60%

Course Outcomes

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

CO	Definition
CO1	Classify different types of control system and analyze their use in various practical applications
CO2	Use different techniques for mathematical modelling of various types of physical systems
CO3	Analyze the nature of time response of feedback control systems and find out system stability using Routh Hurwitz's criteria and root locus technique
CO4	Discuss procedure for determining the stability of a control system based on sinusoidal frequency response
CO5	Design a stable network meeting desired needs within realistic constraints using concept of feedback compensation
CO6	Demonstrate the domain knowledge of various control system components such as error detectors, synchros, potentiometers etc.

Syllabus: **[Total Contact Hours: 42+14(T) =56]**

Part A

Unit 1. Introductory Concepts **[7+2=9]**

Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant & invariant, continuous and sampled data control systems, Block diagrams, some illustrative examples.

Unit 2. Modelling **[6+2=8]**

Formulation of equation of linear electrical, mechanical, thermal, pneumatic, hydraulic system, electrical, mechanical analogies, Transfer function, Block diagram representation, Signal flow graphs and associated algebra, characteristics equation.

Unit 3. Time domain analysis **[6+2=8]**

Typical test–input signals, Transient response of first and second order systems, Time domain specifications, Dominant closed loop poles of higher order system, Steady state error and coefficients, pole- zero location and stability, Routh-Hurwitz Criterion.

Part B

Unit 4. Root Locus Technique **[6+2=8]**

The extreme points of the root loci for positive gain, Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain, sketch of the root locus plot.

Unit 5. Frequency Domain Analysis [7+2=9]

Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems, Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

Unit 6. Compensation [5+2=7]

Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead- compensation.

Unit 7. Control Components [5+2=7]

Error detectors – potentiometers and synchros, servo motors, ac and dc techno generators, magnetic amplifiers.

Text Books:

1. B. S. Manke, "Linear Control Systems", Khanna Publishers, 11th Edition, 2012.
2. I. J. Nagrath and M. Gopal, "Control System Engineering", Wiley Eastern Ltd, 3rd Edition, 2000.

Reference Books:

1. R. C. Dorf and R. H. Bishop, "Modern Control System", Addison –Wesley, Pearson Education, 8th Edition, 2004.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th Edition, 2010.
3. B. C. Kuo, "Automatic Control System", Prentice Hall, 7th Edition, 2000.
4. S. Janardhanan and Y. Singh, "Modern Control Engineering", Cengage Learning, 2010.

E books and online learning materials:

1. http://www.ece.mcmaster.ca/~davidson/EE3CL4/slides/Feedback_handout.pdf.
2. https://www3.nd.edu/~pantsakl/Publications/348A-EEHandbook05.pdf.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/108101037/3.
2. http://nptel.ac.in/courses/108101037/15

Course Title	**Information Management and Data Analytics**			
Course Code	**HSMEC-101**			
Internal Marks	**40**	**L**	**T**	**P**
External Marks	**60**	**3**	**0**	**0**

Numerical & Design Problems Content: 10%-20%

Course Outcomes

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

CO	Definition
CO1	Create an awareness in upcoming managers, of different types of information systems in an organization
CO2	Analyze the relationship between Management Information Systems (MIS) and Functional areas in an organisation
CO3	Assess the relationship between managerial and technological perspectives
CO4	Apply systems thinking to understand complex system behavior, including interactions between components and with other systems (social, cultural, legislative, environmental, business, etc.)
CO5	Analyze the correlation between different variables to establish new relationships and patterns
CO6	Solve Business Problems using Data Analytic Tools

Syllabus: **[Total Contact Hours: 42]**

Part A

Unit 1. Introduction to Management Information Systems (MIS) [6]

Information and its types, Need and Classification of Information Systems, Management Hierarchy, Functions of MIS, Dimensions and Resources for Information Systems.

Unit 2. Data Management Sub Systems (DMSS) [8]

Components, Role of DMSS in Business, Applications, Executive Support Systems (ESS): Definition, Capabilities, Advantages and Disadvantages, Decision Support Systems (DSS): Characteristics, Classification, Construction, Advantages and Disadvantages, Executive Information Systems (EIS): Definition, characteristics, critical success factors.

Unit 3. Business Intelligence (BI) and E-Commerce [6]

Definition, Functions, Applications of BI, Business Process Reengineering, E-Commerce, Applications, M-Commerce, Applications, E-Governance, Role of Business Intelligence in E-Commerce.

Part B

Unit 4. Introduction to Data Analytics [6]

Big Data, Characteristics, Analytics and its Types, Analytics Life Cycle, Model Building and Validating, Learning in a data analytical model.

Unit 5. Data Analysis Techniques [10]

Regression Analysis: Linear Regression, Logistic Regression, Perceptron Learning Algorithm, Classification Techniques: Support Vector Machine (SVM), Prediction Trees: Decision Tree, Regression Tree.

Unit 6. Applications of Data Analysis [6]

Applications of data analysis in banking, healthcare, digital marketing, agriculture, gaming and risk management

Text Books:

1. James A. O'Brien, George Marakas "Management Information System", McGraw-Hill Higher Education, 9 edition, 2008
2. C. Laudon Kenneth, P. Laudon Jane (Author), "Management Information System", Pearson Education, Fifteenth edition, 2018.
3. U Dinesh Kumar, "Business Analytics: The Science of Data - Driven Decision Making", Paperback Publishers Wiley, 2017.
4. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, First edition (1 July 2017).

Reference books and other resources:

1. Rafael LapiedraAlcami, Carlos DeveceCaranana, "Introduction to Management Information Systems" UniversitatJaume Publications, 2012 (Available online).
2. Abu-Mostafa, Magdon-Ismail and Lin, "Learning from Data", AML Book (Available online)
3. E. Alpaydin, "Introduction to Machine Learning", MIT Press, 2014

E books and online learning materials:

1. http://www.jimssouthdelhi.com/studymaterial/BBA2/final%20bba%20MIS%20notes.pdf
2. https://www.datameer.com/pdf/big-data-analytics-ebook.pdf?mkt_tok

MOOCS and Video Course:

1. Information Management: https://nptel.ac.in/courses/122105022/
2. Data Analytics: https://nptel.ac.in/courses/110106072/

Course Title	**Analog Circuits - Lab**			
Course Code	**LPCEC-103**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

NOTE: Do all Experiments.Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition
CO1	Demonstrate various coupling techniques for transistor circuits.
CO2	Conduct experiments to observe the response of push-pull power amplifiers, tuned amplifier and amplifier with negative feedback.
CO3	Analyze the output waveforms of LC and RC oscillators for different oscillation frequency.
CO4	Apply op-amp in inverting, non-inverting & differential configuration and observe its output.
CO5	Demonstrate the use of op-amp as summing, scaling, averaging amplifier and Schmitt trigger circuit.
CO6	Design circuits like differentiator, integrator and 1st order Butterworth filters using op-amp to meet specified needs.

Syllabus:

Experiment 1. To demonstrate RC, transformer and direct coupling technique fortransistor amplifier.

Experiment 2. To plot frequency response of a tuned amplifier.

Experiment 3. To plot the characteristics of Class A, B and AB push pull amplifier and calculate efficiency.

Experiment 4. To analyze the effect of negative feedback on amplifier gain.

Experiment 5. To observe the response of RC phase shift oscillator and determine frequency of oscillation.

Experiment 6. To observe the response of Hartley oscillator and determine frequency of oscillation.

Experiment 7. To observe the response of Colpitts oscillator and determine frequency of oscillation.

Experiment 8. To observe the response of Wien Bridge oscillator and determine frequency of oscillation.

Experiment 9. To measure the output of an op-amp in the inverting and non-inverting configuration.

Experiment 10. To measure the output of an op-amp in the differential amplifier configuration.

Experiment 11. To measure the output of summing, scaling and averaging op-amp circuits.

Experiment 12. To measure the output of op-amp as an integrator and differentiator.

Experiment 13. To design low-pass, high-pass and band-pass 1st order Butterworth active filters using op-amp.

Experiment 14. To verify the operation of an op-amp as Schmitt trigger.

Experiment 15. To simulate the op-amp circuits in software and verify the hardware results.

Reference Books and Other Resources:
Lab manuals available in lab.

MOOCS and Video Course:

1. http://nptel.ac.in/courses/117103063/16
2. http://nptel.ac.in/courses/117103063/23
3. http://nptel.ac.in/courses/108106068/2
4. http://nptel.ac.in/courses/108106068/5

Course Title	**Measurement and Control - Lab**			
Course Code	**LPCEC-104**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

NOTE: Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

CO	Definition
CO1	Calculate the displacement using LVDT.
CO2	Measure inductance, resistance and capacitance using different bridges.
CO3	Examine the output characteristics of thermocouple.
CO4	Analyze the characteristics of various control components like potentiometer, synchros and servomotor
CO5	Analyze the control action of PID controller.
CO6	Formulate and design Composite-type filters.

Syllabus:

Experiment 1. Measurement of displacement using LVDT and determine its output characteristics.
Experiment 2. Measurement of medium resistance by Wheatstone bridge.
Experiment 3. Measurement of inductance by Maxwell's bridge.
Experiment 4. Measurement of small resistance by Kelvin's bridge.
Experiment 5. Measurement of capacitance by Schering Bridge.
Experiment 6. Measurement of frequency by Wein Bridge.
Experiment 7. Study characteristics of temperature transducer like thermocouple.
Experiment 8. To study the I/O characteristics of potentiometer and to use two potentiometers as an error detector.
Experiment 9. Study the transmitter receiver characteristics of a synchro set and to use set as control component.
Experiment 10. To study the operation of dc positioned servomotor and ac positioned servomotor and obtain speed-torque characteristics of ac and dc servomotor.
Experiment 11. Design different compensation networks for the given cutoff frequencies and to plot frequency response of these networks.
Experiment 12. Study PID controller and to obtain the effect of proportional, integral and derivative control action.
Experiment 13. To design and obtain the characteristics of composite low pass filter and high pass filter.

Reference Books and Other Resources:
Lab manuals available in lab.

Online videos:

1.https://www.youtube.com/watch?v=GeET9Z1dbnA&index=8&list=PLv_Pw5IjPpkKm9RACkDUrzr4RnoE1YdKv

2. https://www.youtube.com/watch?v=_Z9ZKCQJhiU

Course Title	**Object Oriented Programming using C++ and Data Structures - Lab**			
Course Code	**LPCEC-105**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

NOTE: Do all Experiments. Evaluation of the lab work shall be done as per the approved Rubric.

Course Outcomes

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

CO	Definition
C01	Create programs with basic object-oriented concepts and implement important features of C++.
C02	Apply the knowledge of C++ to access data through constructors and initializer list.
CO3	Develop the object oriented skills like inheritance and polymorphism to solve real world problems.
CO4	Compile codes with good coding practices on advanced features of C++.
CO5	Understand how several fundamental algorithms work particularly those concerned with Array, Stack and Queue.
CO6	Work in a team to demonstrate an application of object oriented programming by engaging in self-learning.

Syllabus:

Write following programs in C++:

Experiment 1. Using basic statements like control statements, looping statements, various I/O statements and various data structures.

Experiment 2. To create classes in C++ for understanding of basic OOPS features.

Experiment 3. To demonstrate the use of static and const data members.

Experiment 4. To demonstrate the use of various types of constructors and destructors.

Experiment 5. To create programs in C++ for understanding initializer list.

Experiment 6. To demonstrate unary and binary operator overloading.

Experiment 7. To demonstrate the use of memory management operators.

Experiment 8. To create programs in C++ to understand various forms of inheritance.

Experiment 9. To demonstrate the use of virtual keyword.

Experiment 10. To create programs in C++ to understand exception handling and templates.

Experiment 11. To implement following operations (using separate functions) on a linear array:

- Insert a new element at end as well as at a given position
- Delete an element from a given whose value is given orwhose position is given
- To find the location of a given element
- To display the elements of the linear array

Experiment 12.	To demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.
Experiment 13.	To demonstrate the use of stack (implemented using linear linked array) in evaluating arithmetic expression in postfix notation.
Experiment 14.	To demonstration the implementation of various operations on a linear queue represented using a linear array.
Experiment 15.	To demonstration the implementation of various operations on a circular queue represented using a linear array.

Reference Books and Other Resources:
Lab manuals available in lab.

Video Course

1. https://www.youtube.com/watch?v=Y00J1EE49Fg
2. https://www.youtube.com/watch?v=HGE0V2uQ--U

Course Title	**Intelligent Signal Processing - Lab**			
Course Code	**LPCEC-106**			
Internal Marks	**30**	**L**	**T**	**P**
External Marks	**20**	**0**	**0**	**2**

Course Outcomes

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

CO#	Course Outcomes (CO)
1	Make use of MATLAB tool to compute and represent data in various formats.
2	Develop code to process the given data in continuous and discrete time domain.
3	Implement basic mathematical operations in Python
4	Design digital FIR filters in Python
5	Analyse signals in frequency domain using FFT in Python
6	Construct a project in a team or individual for given problem using MATLAB/Python.

Detailed Contents:

Experiment 1 To compute basic mathematical quantities and perform operations on arrays using MATLAB.

Experiment 2 To generate 2D and 3D plots using script and function files.

Experiment 3 To create MATLAB code for the generation of unit step, unit impulse, exponential and ramp signal in continuous and discrete domain..

Experiment 4 To create MATLAB code for performing operations on continuous-time signals like addition, multiplication, shifting, folding and scaling.

Experiment 5 To compute Fourier transform and inverse Fourier Transform of the signal in MATLAB.

Experiment 6 To compute convolution and correlation between continuous-time signals.

Experiment 7 To generate random sequences for the following distribution and plot probability density function:

- Rayleigh Distribution
- Uniform distribution
- Gaussian distribution

Experiment 8 To perform basic mathematical operations on matrices using python

Experiment 9 To create graphs in Python using the matplotlib library

Experiment 10 To generate a non prime list from an ordinary list of numbers in python.

Experiment 11 To demonstrate how to use signalUtility functions for generation and sampling of signals.

Experiment 12 To design a digital FIR Filter using Python.

Experiment 13 To demonstrate how to use FFT for frequency domain analysis.

Experiment 14 To separate a noisy mixture of 3 sinusoidal waves using frequency domain filtering.

Reference Books

1. R. Pratap, "Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press, 2010.
2. Luis F. Chaparro, "Signals and Systems using MATLAB", Elsevier, 2nd Edition, 2015.
3. Martin C. Brown, "Python TheComplete Reference", McGraw Hill Education.
4. Allen B. Downey, "Think Python", 1st Edition, Green Tea Press, 2012.
5. Lab manuals available in Lab.

E-Books and online learning material

1. Learning Python byFabrizio Romanohttp://www.allitebooks.com/learning-python/

Accessed on Feb. 28, 2019.

2. Beginning Programming with Python for Dummies by John Paul Mueller

http://www.allitebooks.com/beginning-programming-with-python-for-dummies-2nd-editionAccessed on Feb. 28, 2019

3. A brief introduction to MATLAB By M.Gerritsen

https://web.stanford.edu/class/cme001/handouts/matlab.pdf Accessed on Feb. 28, 2019

MOOCS and Video Course

1. https://nptel.ac.in/courses/112105232/22# Accessed on Feb. 28, 2019
2. https://nptel.ac.in/courses/103106118/ Accessed on Feb. 28, 2019
3. https://nptel.ac.in/courses/115104095 Accessed on Feb. 28, 2019
4. https://nptel.ac.in/courses/106106145 Accessed on Feb. 28, 2019

Course Title	**Seminar and Technical Report Writing for Engineers**			
Course Code	**PREC-101**			
Internal Marks	**50**	**L**	**T**	**P**
External Marks	**-**	**0**	**0**	**2**

- Imparting skills for seminar preparation and seminar delivery using latest available tools