Semester - 4 (Theory-6, Lab-3, MC-1)							
Sl. No	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	HSC	22A0022T	Managerial Economics & Financial Analysis	3	0	0	3
2	ESC	22A0205T	Electrical Engineering	3	0	0	3
3	PCC	22A0414T	Electromagnetic Waves and Transmission Lines	3	0	0	3
4	PCC	22A0415T	Analog & Digital Communications	3	0	0	3
5	PCC	22A0416T	Linear IC Applications	3	0	0	3
6	PCC (Lab)	22A0417T	Linear IC Applications Lab	0	0	3	1.5
7	ESC (Lab)	22A0206P	Electrical Engineering Lab	0	0	3	1.5
8	PCC (Lab)	22A0418P	Analog & Digital Communications Lab	0	0	3	1.5
9	SC	22A0419P	**Skill Oriented Course:** PCB & Circuit Designing	1	0	2	2
10	MC	22A0027M	**Mandatory Course:** Environmental Studies	2	0	0	0
						Total credits	**21.5**
Community Service Internship (Mandatory) for 6 weeks duration during summer vacation							

Category	Credits
Humanities and Social Science Course (HSC)	3
Engineering Science Course (ESC)	4.5
Professional Core Courses (PCC)	12
Skill oriented Course (SC)	2
Total	21.5

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					
Course Code	**L: T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0022T	**3:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**HSC**

Course Objectives:

- To understand the concepts of managerial economics and financial analysis this helps inoptimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with theproduction and factors of production.
- To have a thorough knowledge regarding market structure and forms of businessorganizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions inpreparing of final accounts.

Syllabus		**Total Hours:48**
Unit -I	**Introduction to Managerial Economics & Demand**	**9 Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticityof Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and
Management.

Unit -II	**Theory of Production and Cost Analysis**	**9 Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Iso costs, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Unit -III	**Introduction to Markets and Forms of Business Organiza**	**10 Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-.

Unit -IV	**Capital and Capital Budgeting**	**10 Hrs**

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value(NPV) – Internal Rate Return (IRR) Method (simple problems)

Unit -V	Introduction To FinancialAccounting And Analysis	10 Hrs

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Managerial Economics, PL Mehata, Sulthan Chand Publications
2. Aryasri: "Business Economics and Financial Analysis", 4th edition, MGH, 2019

Reference Books:

1. Ahuja Hl "Managerial economics" 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: "Managerial Economics and Financial Analysis", New Age International, 2013.
3. Joseph G. Nellis and David Parker: "Principles of Business Economics", 2nd edition, Pearson, New Delhi.
4. Domnick Salvatore: "Managerial Economics in a Global Economy", Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

Course Outcomes (CO):

On completion of this course, student will be able to:

CO1: Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.

CO2: Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis.

CO3: Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange.

CO4: Interpret various techniques for assessing the proposals of project for financial position of the business.

CO5: Evaluate the capital budgeting techniques

CO6: Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts.

ELECTRICAL ENGINEERING					
Course Code	**L: T:P:C**	**Credits**	**ExamMarks**	**Exam Duration**	**Course Type**
22A0205T	**3: 0:0:0**	**3**	**CIE: 30** **SEE:70**	**3Hours**	**ESC**

Course Objectives:

Student will be able to:

- Distinguish between classical method and Laplace transform approach in analyzing transient phenomenon in DC excitations
- Understand and design the different types of filters.
- To know about various characteristics of DC Generators and motors.
- To know about principle of operation of a DC machine working as a generator and motor.
- To understand computation and predetermination of regulation of a 1-ϕ transformer
- To know about principle of operation of three phase induction motor.

UNIT- I	**Transient Analysis**	**10Hrs**

Introduction, Source free R-L, R-C circuits, R-L, R-C circuits with DC, step, pulse forcing functions, Source free R-L-C circuits – under damped, over damped and critical damped cases, Response of RL-Ccircuits with DC and Sinusoidal forcing functions, Relationship between bandwidth and Quality factor in R-L-C circuits – Response of R-L-C circuits using Integral-differential equation and Laplace Transform approaches for dc And – Problem Solving.

UNIT-II	**Frequency Response**	**9Hrs**

Introduction, Series and Parallel Resonant circuits, Resonant frequency, Relationship between bandwidth and Quality factor, Variation of resonant frequency with circuit elements, Passive Filters – Low pass, High pass, band pass, band elimination filter, – Problem Solving-3 Phase circuits.

UNIT-III	**Two-port Networks**	**10Hrs**

Introduction, Types of two port networks, Various parameters of two port networks, Impedance, Admittance, Transmission, Hybrid parameters and their relations – Finding the two port parameters for various circuits, Concept of transformed network, conversion from one parameter to other parameters– Problem solving.

UNIT-IV	**DC Machines**	**10Hrs**

DC Generators: Principle of operation of DC machines – EMF equation – types of generators – applications of dc generators Magnetization and Load characteristics of DC generators

DC Motors: Principle of operation of DC Motor, Types of Motors, Back EMF Equation, Characteristics of DC motor, Torque Equation, Three Point starter, Efficiency Calculation, and speed control.

UNIT-V	**AC Machines**	**9Hrs**

Transformers: Construction and principle of operation of single-phase transformer –EMF equation O.C & S.C. tests – efficiency Induction Motors: Principle and operation of three phase induction motors – Constructional details – Torque equation- slip torque characteristics and power flow equations of –phase IM

Alternators: Principle and operation of alternators – EMF equation – parallel operation of alternators.

Textbooks:

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, "Engineering Circuit Analysis",Mc Graw Hill,9th edition, 2019.
2. Charles Alexander & Mathew Sadiku, "Fundamentals of Electric Circuits", 6th edition,McGraw HillPublications, 2016.
3. I. J. Nagrath&D.P.Kothari, "Electric Machines", 7th Edition, Tata Mc Graw Hill, 2005.

Reference Books:

1. M.E. Van Valkenberg, "Network Analysis", 3rd Edition, Prentice Hall (India), 1980.
2. B. R. Gupta, "Fundamentals of Electric Machines", Vandana Singhal, 3rd Edition, New ageInternational Publishers, 2005.
3. T.K. Nagsarkar and M.S. Sukhija, "Basic Electrical Engineering", 3rd Edition, Oxford University Press2017.
4. S. Kamakashiah, "Electromachanics – III", overseas publishers Pvt. Ltd.
5. V.K. Mehta an2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBSPublishers, 2004.
6. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc21_ee71/preview

https://onlinecourses.nptel.ac.in/noc21_ee24/preview

Course Outcomes (CO):

After the completion of the course students will be:

CO1: Able to acquire knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.

CO2: Able to solve the problems on R L C circuits for different excitations using different approaches.

CO3: Analyze the complex circuits of R L C circuits

CO4: Able to solve the problems the e.m.f. generated on DC Generator.

CO5: Design winding diagrams of AC machines and equivalent circuit of transformer.

CO6: Able to acquire knowledge about how to determine the efficiency and regulation of single phase transformer and synchronous machine.

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Course Code	L: T:P	Credits	Exam.Marks	Exam Duration	Course Type
22A0414T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce fundamentals of static and dynamic electromagnetic fields.
- To teach the application of vector calculus for problem solving in Electromagnetic fields.
- To introduce Maxwell's equations in wave concept.
- To introduce the propagation of electromagnetic waves intransmission lines and their practical applications.
- To analyze the behaviour of electromagnetic waves propagated in normal andoblique incidences.

Syllabus

Unit –I **Static Electric Fields** **10 Hrs**

Recap of Vector Analysis: Coordinate systems and transformation-Cartesian, Cylindrical and Spherical coordinate

Recap of Vector Calculus: Differential length area and volume, line surface and volume integrals, Del operator, gradient, divergent and curl operations.

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Divergence Theorem, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

Unit –II **Static Magnetic Fields & Time varying Fields** **10 Hrs**

Magnetic Fields: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic dipole, Ampere's Force Law, Inductances and Magnetic Energy, Illustrative Problems.

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's equations for time varying fields, Maxwell's Equations in Different Final Forms and Word Statements, Illustrative Problems

Unit –III **Boundary Conditions and Uniform Plane Wave** **10 Hrs**

Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Wave Equations for Conducting and Perfect Dielectric Media.

Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization, Illustrative Problems

Unit –IV **Reflection and Refraction of Plane Waves** **9 Hrs**

Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Poynting Vector, and Poynting Theorem, Illustrative Problems.

Unit –V	Transmission Lines	9 Hrs

Transmission Lines: Introduction, Transmission line parameters, Transmission line equivalent circuit, Transmission line equations and their solutions in their phasor form, input impedance, standing wave ratio, Transmission of finite length- half wave, quarter wave transmission line, Smith chart, graphical analysis of transmission lines using Smith chart, stub matching- single and double stub matching, Illustrative Problems

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 4th edition. Oxford Univ. Press,2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", 7thedition.,TMH,2006.

References:

1. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2ndEdition, PHI, 2000.
2. John D. Krauss, "Electromagnetics", 4th Edition, McGraw- Hill publication, 1999.
3. Electromagnetics, Schaum's outline series, 2nd Edition, Tata McGraw-Hill publications,2006.

Course Outcomes:

After the completion of the course students will able to:

CO1: Describe vector algebra, coordinate systems, vector calculus and fundamentals of electrostatic fields' duo to point, line, sheet, and volume charges using Coulomb's law and Gauss's law.

CO2: Calculate magnetic field intensity using Biot-Savart's law and Ampere's law

CO3: Analyze Maxwell's equations for Time-varying EM fields.

CO4: Analyze boundary conditions of EM fields for dielectric-dielectric, dielectric-conductor media.

CO5: Describe the propagation of UPW in good conductor, good dielectric, Dielectric-Dielectric, Dielectric-Conductor media.

CO6: Analyze the concept of transmission lines and their applications.

ANALOG & DIGITAL COMMUNICATIONS					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0415T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- Able to compute the bandwidth and transmission power by analyzing time and frequency domain spectra of signal required under various modulation schemes.
- Able to apply suitable modulation schemes various applications.
- Able to analyze analog modulation techniques by using signal processing tools. To introduce the different digital modulation techniques such as PCM, DM and various shift keying techniques, information theory and different source coding techniques.
- To introduce different error detecting and error correcting codes like block codes, cyclic codes and convolution codes.

Syllabus

Unit –I	**10 Hrs**

Amplitude Modulation: Need for modulation, Amplitude Modulation - Time and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector, DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, Costas Loop, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation.

Unit –II	**10 Hrs**

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM, Super heterodyne receiver.

Introduction to Noise: Types of Noise, Receiver Model, Noise in AM, DSB, SSB, and FM Receivers, Pre-Emphasis and De-emphasis in FM.

Unit –III	**10 Hrs**

Pulse Modulation: Types of Pulse modulation- PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

Baseband Pulse Transmission: Introduction, Matched Filter, Properties of Matched Filter, Error rate due to noise, Inter Symbol Interference (ISI), Nyquist criterion for distortion less baseband binary transmission, Correlative level coding, Baseband M-ary PAM transmission, QAM, Equalization, Eye pattern.

Unit –IV	**9 Hrs**

Digital Pass band Transmission: Introduction, Pass band Transmission Model, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of bank of correlators in noise, Correlation receiver, Probability of Error, Detection of Signals with unknown phase.

Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK, Non-coherent BFSK, and DPSK.M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Timing and Frequency Synchronization.

Unit –V	9 Hrs

Channel Coding: Error Detection & Correction - Repetition & Parity Check Codes, Interleaving, Code Vectors and Hamming Distance, Forward Error Correction (FEC) Systems, Automatic Retransmission Query (ARQ) Systems, Linear Block Codes – Matrix Representation of Block Codes, Convolutional Codes – Convolutional Encoding, Decoding Methods.

Text Books:

1. Simon Haykin, "Communication Systems", John Wiley& Sons, 4th Edition, 2004.
2. B. P. Lathi, Zhi Ding "Modern Digital and Analog Communication Systems", Oxford press,2011.

References:

1. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley& Sons, 1999.
2. Bernard Sklar, F. J. Harris, "Digital Communications: Fundamentals and Applications", Pearson Publications, 2020.
3. Taub and Schilling, "Principles of Communication Systems", Tata McGraw Hill, 2007.

Course Outcomes:

After the completion of the course students will able to:

CO1: Recognize the basic terminology used in analog and digital communication techniques for transmission of information/data.

CO2: Explain the basic operation of different analog and digital communication systems at baseband and pass band level.

CO3: Compute various parameters of baseband and pass band transmission schemes by applying basic engineering knowledge.

CO4: Analyze the performance of different modulation & demodulation techniques to solve complex problems in the presence of noise.

CO5: Evaluate the performance of all analog and digital modulation techniques to know the merits and demerits of each one of them in terms of bandwidth and power efficiency.

CO6: Understand the basics of information theory and error correcting codes.

LINEAR IC APPLICATIONS

Course Code	L: T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0416T	3:0:0	3	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To teach the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- To understand and implement the working of basic digital circuits.

Syllabus

Unit –I	10 Hrs

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, and Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparator and its applications, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

Unit –II	10 Hrs

OP-AMP, IC-555 & IC 565 Applications: Introduction To Active Filters, Characteristics of Band Pass, Band Reject And All Pass Filters, Analysis Of 1st Order LPF& HPF Butterworth Filters, Waveform Generators - Triangular, Saw-Tooth, Square Wave, IC555 Timer - Functional Diagram, Monostable And Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

Unit –III	10 Hrs

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel ComparatorType ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

Unit –IV	9 Hrs

Digital Integrated Circuits: Classification of Integrated Circuits, Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoder, Encoder, Priority Encoder, Multiplexer, De-multiplexer, Parallel Binary Adder/ Subtractor, Magnitude Comparator.

Unit –V	9 Hrs

Sequential Logic Ic's and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, conversion of Flip-flops, Synchronous Counter, Decade Counter, Shift Register. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Text Books:

1. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.

2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 2003.

3. Digital fundamentals – Floyd and Jain, Pearson Education,8th Edition ,2005.

References:

1. Op Amps & Linear Integrated circuits-Concepts and Applications James M.Fiore,Cengage Learning/Jaico,2009.

2. Operational Amplifiers with linear integrated circuits by K.Lal kishore-Pearson,2009.

3. Linear integrated circuits and applications-Salivahana,TMH.

4. Modern digital electronics-RP Jain-4/e-TMH,2010.

5. Digital design principles and practices-John.F.Wakerly 3/e,2005.

Course Outcomes:

After the completion of the course students will able to:

CO1: List out the characteristics of Linear and Digital ICs.

CO2: Discuss the various applications of linear & Digital ICs.

CO3: Solve the application-based problems related to linear and digital ICs.

CO4: Analyze various applications-based circuits of linear and digital ICs.

CO5: Design the circuits using either linear ICs or Digital ICs from the given specifications.

CO6: Understand the various type of Memory Architectures using the Digital ICs.

LINEAR IC APPLICATIONS LAB

Course Code	L: T:P	Credits	Exam.Marks	Exam Duration	Course Type
22A0417T	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PCC

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyze the characteristics of Diodes, BJT, MOSFET.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

Syllabus

MINIMUM TWELVE EXPERIMENTS MUST CONDUCT: (Six from each part A & B)

PART -A:

TO VERIFY THE FOLLOWING FUNCTIONS

1. Adder, Subtractor, Comparator Circuits using IC 741 OP AMP.
2. Integrator and Differentiator Circuits using IC 741 OP AMP.
3. Active Low pass, High pass Butterworth (Second Order).
4. RC Phase Shift and Wien Bridge Oscillators using IC 741 Op-Amp.
5. IC 555 Timers – Monostable Operation Circuits.
6. Schmitt Trigger Circuits – using IC 741 and IC 555.
7. IC 565 –PLL applications
8. Voltage Regulator using IC 723, Three terminal voltage regulators 7805,7809, 7912
9. Sample and Hold LF398 IC

PART –B:

TO VERIFY THE FOLLOWING FUNCTIONALITY OF THE FOLLOWING 74 SERIES TTL ICS

1. D-Flip Flop (74LS74) and JK Master Slave Flip-flop(74LS73)
2. Decade counter (74LS90) and Up-down Counter (74LS192)
3. Universal shift Register(74LS194/195)
4. 3-8 Decoder using (74LS138).
5. 4 – bit comparator (74LS85)
6. 8x1 Multiplexer - 74LS151 and 2x4 DeMultiplexer-74155.
7. RAM 16X4 -74189(read and write operation)
8. Stack and queue implementation using RAM, 74189

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. Bread Boards
6. Components: - IC741, IC555, IC566, IC1496, IC723, 7805, 7809, 7912 and other Essential components.
7. Analog IC Tester

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand the characteristics of Linear and Digital ICs.

CO2: Design circuits using operational amplifiers for various applications

CO3: Analyze various applications-based circuits of linear and digital ICs

CO4: Design various combinational circuits using various Digital Integrated IC's.

CO5: Design various Sequential Logic circuits and Memories circuits using various Digital Integrated IC's.

CO6: Understand differences between Linear and Digital Integrated IC's.

ELECTRICAL ENGINEERING LAB					
Course Code	**L: T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0206P	**0: 0:3:0**	**1.5**	**CIE: 30 SEE:70**	**3Hours**	**ESC**

Course Objectives:

- Apply and experimentally analyze two port network parameters
- To do experiments on DC Machines
- To do experiments on AC Machines

LIST OF EXPERIMENTS

1. Response of RL and RC circuits for pulse inputs.
2. Determination of Z & Y parameters for the given two port network.
3. Determination of Transmission and Hybrid Parameters of a given two port networks
4. OCC of DC Shunt generator.
5. Load characteristics of DC shunt generator.
6. Load characteristics of DC series generator.
7. Load characteristics of DC shunt motor
8. Swinburne's test.
9. Speed control of DC shunt motor.
10. OC & SC tests on a 1-φ transformer.
11. Load test on Squirrel cage Induction motor.
12. Predetermination of regulation of alternator by Synchronous impedance method.Note: Student has to perform at least 10 experiments.

Reference Books:

1. D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand & Bros

Web References:

1. Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of EEE http://vem-iitg.vlabs.ac.in/
2. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
3. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

Course Outcomes (CO):

After completion of the course, students will be able to:

CO1: Determine the various parameters experimentally

CO2: Understand various characteristics of DC generators.

CO3: Understand various characteristics of DC motors.

CO4: Predetermine the efficiency and regulation of a 1-φ transformer.

CO5: Predetermine the efficiency and regulation of an Alternator.

CO6: Determine the efficiency of a Squirrel cage Induction motor.

ANALOG & DIGITAL COMMUNICATIONS LAB					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0418P	**0:0:3**	**1.5**	**CIE:30** **SEE:70**	**3 Hours**	**PCC**

Course Objectives:

- To understand the basics of analog and digital modulation techniques.
- To design and implement different modulation and demodulation techniques and their applications.
- To analyze the Pulse modulation techniques.

Syllabus

LIST OF EXPERIMENTS:

Note: Conduct any six experiments from each section.

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. FM Modulation and Demodulation
4. Radio receiver measurements
5. PAM Modulation and Demodulation
6. PWM Modulation and Demodulation
7. PPM Modulation and Demodulation

Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BFSK Modulation and Demodulation
6. QPSK Modulation and Demodulation
7. DPSK Modulation and Demodulation

Tools / Equipment Required:

1. CROs: 20MHz
2. Function Generators: 2MHz
3. Spectrum Analyzer
4. Regulated Power Supplies: 0-30V
5. Analog and Digital Modulation and Demodulation Trainer Kits.

Course Outcomes:

After the completion of the course students will able to:

CO1: Know about the usage of equipment/components/software tools used to conduct the experimentsin analog and digital modulation techniques.

CO2: Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally.

CO3: Analyze the performance of a given modulation scheme to find the important metrics of thesystem theoretically.

CO4: Draw the relevant graphs between important metrics of the system from the observedmeasurements.

CO5: Compare the experimental results with that of theoretical ones and infer the conclusions.

CO6: Design and implement different modulation and demodulation techniques.

PCB & CIRCUIT DESIGNING					
Course Code	**L: T:P**	**Credits**	**Exam.Marks**	**Exam Duration**	**Course Type**
22A0419P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**SC**

Course Objectives:

- This course will teach how to design and fabricate PCB for prototyping as well as in Industrial Production environment.
- This will help students to innovate faster with electronics technology.

Syllabus	**Total Hours: 48**

UNIT I

Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, creating new PCB, browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT II

Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation(EDA)tools and comparison.

UNIT III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards.

Practice Exercises: Any twelve experiments are to be done

1. Practice following PCB Design steps
   - Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Net list generation.
   - Layout Design: Familiarization of Foot print Editor, Mapping of components, Creation of PCB layout Schematic.
   - Create new schematic components.
   - Create new component footprints.
2. Regulator circuit using 7805
3. Inverting Amplifier or Summing Amplifier using op-amp
4. Full-wave Rectifier
5. Astable multivibrator and Monostable multivibrator using IC555
6. Calling bell circuit and Temperature measuring circuit.
7. Automatic street light using LDR sensor.
8. LED Chaser using 4017B decoded counter and IC555.
9. Water level indicator using IC555.
10. Sequenced display of traffic lights using IC555 and IC74LS190.
11. Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor,headers, LED.

12. Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector, Jumper, LEDs
13. Design an 8051 Development board having Reset & Input/output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors.
14. Fabricate a single-sided PCB, mount the components, and assemble them in a cabinet for any one of the circuits mentioned in the above exercises.

Text Book:

1. Printed circuit board design ,fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006

References:

1. Printed circuit Board Design and technology, Walter C. Bosshart
2. Printed Circuits Handbook, Sixth Edition,by Clyde F. Coombs, Jr, Happy T. Holden,Publisher: McGraw-Hill Education Year: 2016

Course Outcomes:

After the completion of the course students will able to:

CO1: Understand a single layer PCB
CO2: Understand a multilayer PCB
CO3: Apply PCB for various applications.
CO4: Design PCB for 8051
CO5: Create and fabricate a PCB
CO6: Evaluate and test a PCB

ENVIRONMENTAL STUDIES
(Common to CSE, AI&ML, ECE, EEE, ME)

Course Code	L: T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0027M	3: 0:0:0	0		3 Hours	MC

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations andpollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

	Syllabus	Total Hours: 48 Hrs
Unit- I	**Multidisciplinary Nature of Environmental Studies and Natural Resources**	**10Hrs**

Definitions, components of Environment, Scope and Importance –Need for Public Awareness

Renewable and non-renewable resources –Forest resources – Use and over – exploitation, deforestation,

– Food resources: World food problems, changes caused by agriculture and overgrazing, effects ofmodern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Unit-II	Ecosystems	9Hrs

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers– Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem

a. Grassland ecosystem.
b. Desert ecosystem

Unit-III	Biodiversity And Its Conservation	10Hrs

Introduction Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values — India as a mega-diversity nation – Hot spots of biodiversity – Threats to biodiversity: habitat loss, poaching Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-IV	Environmental Pollution	9Hrs

Definition, Cause, effects and control measures of:

a. air pollution
b. water pollution
c. noise pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes

Unit-V	Social Issues and The Environment	10Hrs

From Unsustainable to Sustainable development – Urban problems related to energy Environment Protection Act. – Air (Prevention and Control of Pollution) act

Definition, Cause, effects and control measures of:

a. Global warming
b. Acid rain
c. Ozone layer depletion

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain –Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses- Erach Bharucha forUniversity Grants Commission, Universities Press.
2. Environmental Studies- Kaushik & kaushik, New Age Pubilishers.

Reference Books:

1. Environmental studies- R.Rajagopalan, Oxford University Press.
2. Comprehensive Environmental studies- J.P.Sharma, Laxmi publications.

Course Outcomes (CO):

After completion of the course, students will be able to:

CO1: Recognize the knowledge about environment, natural resources and different techniques involved in its conservation.

CO2: Describe the information about different eco-systems and its functions.

CO3: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO4: Explain the different types of bio-diversity along with values and conservation methods.

CO5: Predict various environmental pollutions and able to design the environmentally friendly process in engineering.

CO6: Apply the sustainable development concepts in life, society and industry.