GUJARAT TECHNOLOGICAL UNIVERSITY

ADVANCE ENGINEERING MATHS
SUBJECT CODE: 2130002
B.E. 3RD SEMESTER

Type of course: Engineering Mathematics

Prerequisite: The course follows from Calculus, Linear algebra

Rationale: Mathematics is a language of Science and Engineering

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**Introduction to Some Special Functions:** Gamma function, Beta function, Bessel function, Error function and complementary Error function, Heaviside's function, pulse unit height and duration function, Sinusoidal Pulse function, Rectangle function, Gate function, Dirac's Delta function, Signum function, Saw tooth wave function, Triangular wave function, Halfwave rectified sinusoidal function, Full rectified sine wave, Square wave function.	02	4
2	**Fourier Series and Fourier integral:** Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion, Forced oscillations, Fourier integral	05	10
3	**Ordinary Differential Equations and Applications:** First order differential equations: basic concepts, Geometric meaning of $y' = f(x,y)$ Direction fields, Exact differential equations, Integrating factor, Linear differential equations, Bernoulli equations, Modeling , Orthogonal trajectories of curves.Linear differential equations of second and higher order: Homogeneous linear differential equations of second order, Modeling: Free Oscillations, Euler- Cauchy Equations, Wronskian, Non homogeneous equations, Solution by undetermined coefficients, Solution by variation of parameters, Modeling: free Oscillations resonance and Electric circuits, Higher order linear differential equations, Higher order homogeneous with constant coefficient, Higher order non homogeneous equations. Solution by [1/f(D)] r(x) method for finding particular integral.	11	20
4	**Series Solution of Differential Equations:** Power series method, Theory of power series methods, Frobenius method.	03	6
5	**Laplace Transforms and Applications:** Definition of the Laplace transform, Inverse Laplace transform, Linearity, Shifting theorem, Transforms of derivatives and integrals Differential equations, Unit step function Second shifting theorem,	09	15

	Dirac's delta function, Differentiation and integration of transforms, Convolution and integral equations, Partial fraction differential equations, Systems of differential equations		
6	**Partial Differential Equations and Applications:** Formation PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Nonlinear PDEs first order, Some standard forms of nonlinear PDE, Linear PDEs with constant coefficients,Equations reducible to Homogeneous linear form, Classification of second order linear PDEs.Separation of variables use of Fourier series, D'Alembert's solution of the wave equation,Heat equation: Solution by Fourier series and Fourier integral	12	15

Reference Books:

1. Advanced Engineering Mathematics (8th Edition), by E. Kreyszig, Wiley-India (2007).
2. Engineering Mathematics Vol 2, by Baburam, Pearson
3. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005)
4. R. V. Churchill and J. W. Brown, Fourier series and boundary value problems (7th Edition), McGraw-Hill (2006).
5. T.M.Apostol, Calculus , Volume-2 (2nd Edition), Wiley Eastern , 1980

Course Outcome:

After learning the course the students should be able to

1. Fourier Series and Fourier Integral
   - Identify functions that are periodic. Determine their periods.
   - Find the Fourier series for a function defined on a closed interval.
   - Find the Fourier series for a periodic function.
   - Recall and apply the convergence theorem for Fourier series.
   - Determine whether a given function is even, odd or neither.
   - Sketch the even and odd extensions of a function defined on the interval [0,L].
   - Find the Fourier sine and cosine series for the function defined on [0,L]
2. Ordinary Differential Equations and Their Applications
   - Model physical processes using differential equations.
   - Solve basic initial value problems, obtain explicit solutions if possible.
   - Characterize the solutions of a differential equation with respect to initial values.
   - Use the solution of an initial value problem to answer questions about a physical system.
   - Determine the order of an ordinary differential equation. Classify an ordinary differential equation as linear or nonlinear.
   - Verify solutions to ordinary differential equations.
   - Identify and solve first order linear equations.
   - Analyze the behavior of solutions.
   - Analyze the models to answer questions about the physical system modeled.
   - Recall and apply the existence and uniqueness theorem for first order linear differential equations.
   - Identify whether or not a differential equation is exact.
   - Use integrating factors to convert a differential equation to an exact equation and then solve.
   - Solve second order linear differential equations with constant coefficients that have a characteristic equation with real and distinct roots.
   - Describe the behavior of solutions.
   - Recall and verify the principal of superposition for solutions of second order linear differential equations.
   - Evaluate the Wronskian of two functions.

- Determine whether or not a pair of solutions of a second order linear differential equations constitute a fundamental set of solutions.
- Recall and apply Abel's theorem.
- Apply the method of reduction of order to find a second solution to a given differential equation.
- Apply the method of undetermined coefficients to solve non-homogeneous second order linear differential equations.
- Model undammed mechanical vibrations with second order linear differential equations, and then solve. Analyze the solution. In particular, evaluate the frequency, period, amplitude, phase shift, and the position at a given time.
- Define critically damped and over damped. Identify when these conditions exist in a system.
- Describe the phenomena of beats and resonance. Determine the frequency at which resonance occurs.
- Recall the definition of linear independence for a finite set of functions. Determine whether a set of functions is linearly independent or linearly dependent.
- Use the method of variation of parameters to solve non-homogeneous higher order linear differential equations.

3. Series Solution of Differential Equations

- Manipulate expressions involving summation notation. Change the index of summation.
- Find the general solution of a differential equation using power series.
- Given an initial value problem, use the differential equation to inductively determine the terms in the power series of the solution, expanded about the initial value.

4. Laplace Transforms and Applications

- Sketch a piecewise defined function. Determine if it is continuous, piecewise continuous or neither.
- Evaluate Laplace transforms from the definition.
- Determine whether an infinite integral converges or diverges.
- Evaluate inverse Laplace transforms.
- Use Laplace transforms to solve initial value problems.
- Convert piecewise defined functions to functions defined in terms of step functions and vice versa.
- Find the Laplace transform of a piecewise defined function.
- Apply the shifting theorems to evaluate Laplace transforms and inverse Laplace transforms.
- Use Laplace transforms to solve differential equations with discontinuous forcing functions.
- Define an idealized unit impulse function.
- Use Laplace transforms to solve differential equations that involve impulse functions.
- Evaluate the Laplace transform of a convolution of functions.
- Use the convolution theorem to evaluate inverse Laplace transforms.

5. Partial Differential Equations and Applications

- Determine the order of a partial differential equation.
- Classify a partial differential equation as linear or nonlinear.
- Verify solutions to partial differential equations.
- Apply the method of separation of variables to solve partial differential equations, if possible.
- Find the solutions of heat conduction problems in a rod using separation of variables.
- Solve steady state heat conduction problems in a rod with various boundary conditions.
- Solve the wave equation that models the vibration of a string with fixed ends.
- Describe the motion of a vibrating string.

- Solve Laplace's equation over a rectangular region for various boundary conditions.
- Solve Laplace's equation over a circular region for various boundary conditions.

List of Open Source Software/learning website:

1. NPTEL
   http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and%20System/Course_home4.30
   https://www.youtube.com/watch?v=DPg5T-YBQjU
   https://www.youtube.com/watch?v=7fJeo1fylKI
   https://www.youtube.com/watch?v=1FnBPmEWpus
   https://www.youtube.com/watch?v=dgDIQ0VA0pA
   https://www.youtube.com/watch?v=SoBs-YGQUdc
   https://www.youtube.com/watch?v=Fh8m6ZdFaqU

2. **Instructor(s):** Prof. Haynes Miller, Prof. Arthur Mattuck

   http://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/video-lectures/

3. **Instructor:** Prof. Haynes Miller, Prof. Arthur Mattuck, Dr. John Lewis

   http://ocw.mit.edu/courses/mathematics/18-03sc-differential-equations-fall-2011/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

ENGINEERING ECONOMICS AND MANAGEMENT
SUBJECT CODE: 2130004
B.E. 3rd/4th SEMESTER

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No	Topics	Hrs.	Module Weightage
1.	Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	04	10%
2.	Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	04	10%
3.	Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.	05	10%
4.	Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control	04	10%
5.	Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	04	10%
6.	Introduction to Management; Definitions, Nature, scope Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory	04	11%
7.	Functions of Management; Planning, Organizing, Staffing, Directing, Controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization.	05	11%
8.	Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation Introduction to Finance Management; meaning, scope, sources, functions	05	11%
9.	Introduction to Production Management; definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it. Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection	05	11%
10.	Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance.	02	6%

Reference Books:

1. Engineering Economics, R.Paneerselvam, PHI publication
2. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
3. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
4. Principles and Practices of Management by L.M.Prasad
5. Principles of Management by Tripathy and Reddy
6. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

Course Outcomes: The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects:

- To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.
- To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory. The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

DESIGN ENGINEERING
SUBJECT CODE: 2130005

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
L	T	P	C	ESE (E)	PA (M)		PA (V)	PA (I)	
					PA	ALA	ESE		
0	0	3	3	0	0	0	80	20	100

Design Engineering 1, 2 and 3

What is design? Design is a plan of a system, its implementation and utilization for attaining a goal. It is to change undesired situation into desired situation means to find solution for undesired/uncomfortable situation.
Designs can be for
(1) Technical systems (power plant)
(2) Educational systems (Montessori Method)
(3) Aesthetic systems (logo designs, advertisements)
(4) Legal systems
(5) Social, religious or cultural systems
(6) Theories, Models, etc.

Design thinking gives students a taste of the rich internal-remunerations associated with knowledge-creation and in curiosity and problem-driven contexts. Design need to satisfy technical functions, ergonomics functions, aesthetic functions, cost function and environment functions.

Essential features of Design:
Design solution of a problem starts with planned constructions for achieving goal/s. Designing means evolving goal oriented processes. At the beginning of the design process only goals are known while at the end, both the goals and plans are known and that to with more clarity. Goal and plans evolve together and they influencing each other. In designing process some goals are more important than others and similarly some plans are better than others. Designing does not guarantee that the design will work.

Design thinking process:
(1) Find goals or need
(2) Evaluate goals or need
(3) Generate proposals to satisfy goals
(4) Evaluate proposals
(5) Improve goals and proposals

Teaching methodology:
The design engineering should be with fun and should create excitement. It should be integrated theme across the various courses. It should promote the team work. Design is thinking and doing. The complete design process should be included in design engineering 1, 2 and 3. The prototype design must consider technical, aesthetic, ergonomics, cost and environmental requirements.

Content:

Design Engineering 1: (3 credits in Semester 3, 3 credits in Semester 4)
Introduction to product innovation process (Need-requirement-concept-detail-prototype-services-business)
Modules on: Task clarification and conceptualization: Problem-idea-solution-evaluation

- Problem identification
- Ideation
- Consolidation
- Evaluation

Project: identifying need to developing proof of concept to demonstrate solution selected

Students can tackle simple design problems with engineering content – posed by the teacher or based on a survey of real life concerns of the public. The second is more effective – the students "own the problem" - but has to be accepted by the teacher.

Examples: (a) A device to help carry heavy luggage to the upper floors of a building – a building that has no lifts. (b) Systems to ensure that water does not come out as a jet from the taps in the lower floors of a tall building. One can insist on multiple realistic solutions and all should be part of the submission along with statements of their shortcomings or advantages. Teacher should not entertain fancy solutions – based on fancy ideas - with no engineering or scientific basis.

Short lectures on the topics in the syllabus should parallel the activity.

Design Engineering 2: (3 credits in Semester 5, 3 credits in Semester 6)
Introduction to detail design
Modules on

- Design for performance, safety, reliability
- Design for ergonomics and aesthetics
- Design for manufacturability
- Design for cost, environment

Project: developing the concept into a detailed design with a functional prototype

Here one could ask students to develop products based on themes - "Garbage compactors, Energy from kitchen waste, etc" making sure that the problems identified by the students within the themes possess an engineering content and insisting on some facets of design for assembly, for manufacturability, ...and so on while preparing the design and the prototypes. One could encourage students to innovate, arrive at multiple solutions and conduct a detailed design of one of the solutions.

Prototyping requires funds and effort, so it pays to identify one subsystem of the design of the whole machine. One can insist on prototyping demonstrating at least that sub-system, if not the whole system.

Design Engineering 3: (3 credits in Semester 7, 3 credits in Semester 8)
Introduction to services and business planning
Modules on

- Design of services
- Intellectual property
- Materials and recourse planning
- Business planning

Project: developing a business model

OR

Research or Technology Development project
Modules on

- Detailed literature survey and to find out technology gap
- Intellectual property
- Re-evaluate prototype of DE-2 and proposal of novel idea

Project: developing a novel functional prototype

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRICAL (09) / ELECTRONICS (10) / ELECTRONICS & COMMUNICATION (11) / INSTRUMENTATION & CONTROL (17)/ POWER ELECTRONICS

CIRCUITS AND NETWORKS

SUBJECT CODE: 2130901

B.E. 3RD SEMESTER

Type of course: Passive circuit analysis and synthesis

Prerequisite: Fundamental knowledge of electric circuit sources and elements, basic mathematics (integration, differentiation, etc.)

Rationale: Students of EC Engineering need to possess good understanding of concepts and principles of passive circuit analysis and synthesis by applying various circuit laws and theorems. This is one of the foundation courses which are required to understand the concepts of advanced courses and develop skills that are needed in Electronics field.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Circuit Variables and Circuit Elements and Sources:** E.M.F, Potential and Potential Difference, Current and Current Density, Ideal and Practical Voltage and Current Sources. Conversion from one source into other. Internal Impedance of voltage and current source relative to load. Two-terminal Capacitance – Two-terminal Inductance- Independent and Dependent Electrical Sources –Power and Energy Relations for Two-terminal Elements – Classification of Two-terminal Elements – Multi-terminal Circuit Elements, Dot Convention.	3	5.72
2	**Nodal Analysis and Mesh Analysis of resistive Circuits:** Nodal Analysis of Circuits Containing Resistors and Independent and Dependent Sources – Source Transformation Theorem for circuits with independent sources – Source Transformation Theorem for circuits with Dependent sources –Nodal Analysis of Circuits Containing Dependent Sources - Mesh Analysis of Circuits with Resistors and Independent Voltage Sources- Mesh Analysis of Circuits with Independent Sources - Mesh Analysis of Circuits Containing Dependent Sources.	5	9.62
3	**Circuit Theorems and Their Application in Electric Networks:** Linearity of a Circuit and Superposition Theorem-Substitution Theorem-Compensation Theorem - Thevenin's Theorem and Norton's Theorem - Determination of Equivalents for Circuits with Dependent Sources - Reciprocity Theorem - Maximum Power Transfer Theorem - Millman's	6	11.54

	Theorem-Duality Theorem-Duality between Electricity and Magnetism		
4	**Time domain response of First order RL and RC circuits:** Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications – First order RC Op Amp Circuits.	4	7.7
5	**Time domain response of Second order linear circuits:** Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs.	4	7.7
6	**Initial Conditions:** Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.	4	7.7
7	**Laplace Transform Analysis and Circuit Applications:** Notions of Impedance and Admittance – Manipulation of Impedance and Admittance- Notions of Transfer Function- Equivalent circuits for inductors and capacitors – Nodal and Loop analysis in the s-domain – Switching in RLC circuits- Switched capacitor circuits and conservation of charge	5	9.6
8	**Laplace Transform Analysis and Transfer Function Applications:** Poles, Zeros and the s-plane- Classification of Responses – Computation of sinusoidal steady state response for stable networks and systems.	4	7.7
9	**Two –Port Networks :** One port networks – Two port admittance Parameters (y parameters)– Admittance parameters analysis of terminated two- Port networks - Two port impedance Parameters (z-parameters) –Impedance and Gain calculations of terminated two- Port networks modeled by z-parameters – Hybrid parameters (h para)– Inverse Hybrid Parameters (g-para)- Transmission parameters (ABCD parameters)-Scattering parameters(S parameters)-Scattering Transfer parameters(T parameters) –reciprocity-Various Combinations of Two-Port network-Various Combinations of Two port n/w.	7	13.5
10	**Introduction to Network Topology:** Linear Oriented Graphs (Connected Graph, Subgraphs and Some Special Subgraphs) - The Incidence Matrix of a Linear Oriented Graph -Kirchhoff's Laws in Incidence Matrix Formulation - Nodal Analysis of Networks – The Circuit Matrix of a Linear Oriented Graph- Kirchhoff's Laws in Fundamental Circuit Matrix Formulation - Loop Analysis of Electrical Networks – (Loop Analysis of Networks Containing Ideal Dependent Sources- Planar Graphs and Mesh Analysis –Duality)- The Cut-set Matrix of a Linear Oriented Graph (Cut-sets - The All cut-set matrix Qa- Orthogonality relation between Cut-set matrix and Circuit matrix - The Fundamental Cut-set Matrix Qf - Relation between Qf , A and Bf) - Kirchhoff's Laws in Fundamental Cut-set formulation - Tie set -Tie set Matrix (F-loop matrix)- Tie set schedule.	7	13.5
11	**Introduction to Passive Network Synthesis:** Introduction of Hurwitz Polynomial, Positive Real Function (PRF), Elementary Synthesis Procedure.	3	5.72
	Total	52	

Reference Books:

1. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication
2. Network Analysis :- By M.E Van Valkenburg PHI Publication
3. Electric Circuits and Networks :- By K. S. Suresh Kumar – Pearson Education
4. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press(Indian edition)

5. Engineering Circuit Analysis : - By W H Hayt, J E Kemmerly, S M Durbin 6th Edition TMH Publication
6. Graphs: Theory and Algorithms By K. Thulasiraman, m.n.s Swamy, Wiley Publication.
7. Electric Circuit Analysis By S N Sivanandam, Vikas Publishing House
8. Introductory Circuit Analysis by Robert Boylestad, Pearson

Course Outcome:

1. To apply various circuit laws like Ohm's Law, KVL, KCL, etc.
2. To apply dot convention technique for analysis of transformer based circuits.
3. To apply node and mesh circuit analysis techniques..
4. To apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, Millman's Theorem, etc..
5. To analyze behavior of passive circuits such as RC, RL and RLC.
6. To apply Laplace Transform for circuit analysis.
7. To obtain transfer function of a network.
8. To analyze circuit taking into account initial conditions.
9. To calculate two port parameters such as y, z, h, ABCD, etc. for the given two port network.
10. To understand basics of network topologies and the tieset and cutset schedules.
11. To understand basics of network synthesis from the transfer function.

List of Experiments:

EXP. NO.	NAME OF THE EXPERIMENT
1.	To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2.	To verify superposition theorem experimentally for a given resistive circuit consisting two independent sources.
3.	To verify Thevenin's theorem experimentally for a given circuit.
4.	To verify maximum power transfer theorem experimentally for a given circuit.
5.	To verify reciprocity theorem experimentally for a given circuit.
6.	To measure and calculate RC time constant for a given RC circuit.
7.	To measure and calculate RC time constant for a given RL circuit.
8.	To measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$(over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
9.	To measure and calculate Z-parameters for a given two-port system.
10.	To measure and calculate Y-parameters for a given two-port system.
11.	To measure and calculate h-parameters for a given two-port system.
12	To measure and calculate ABCD-parameters for a given two-port system.

Design based Problems (DP)/Open Ended Problem (to be modified):

1. Write a 'c' program to obtain RC time constant from a given step response of RC circuit.
2. Write a 'c' program to plot frequency response of RC circuit for different values of R and C.
3. Write a 'c' program to obtain 3-dB bandwidth and RC time constant from a given frequency response of RC circuit.
4. Write a 'c' program to plot impedance of a given series RLC circuit as a function of frequency. Also obtain minimum value of impedance and series resonance frequency using 'c' program.

5. Write a ‘c’ program to obtain following parameters from step response of series RLC circuit for different values of R, L and C.
    a. Propagation delay
    b. Overshoot
    c. Undershoot
    d. Damping factor
    e. Natural frequency
    f. Settling time

Major Equipments:

i. Function Generator
ii. Oscilloscope
iii. Digital Multi-meter
iv. DC Power Supply (0-30 V)

C. List of Software:

Multisim, PSPice, NGspice (**Open Source Software)**

Learning website:

www.nptel.ac.in, www.allaboutcircuits.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS (10) / ELECTRONICS & COMMUNICATION (11) /INSTRUMENTATION & CONTROL (17)

ELECTRICAL MACHINES

SUBJECT CODE: 2131005

B.E. 3RD SEMESTER

Type of course: Engineering Science **(ELECTRICAL)/(INTERDISCIPLINARY)**

Prerequisite: Fundamentals of Electrical Engineering

Rationale: NA

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	4	70	20	10	20	10	20	150

Contents:

Sr. No.	Subject Content	Hours	Module Weightage
1.	**Transformers:** **Single Phase Transformer:** Working principle, Construction, types, EMF equation, Transformer on no load and on load, vector diagram, exact and approximate equivalent circuit, O.C & S.C.test on transformer, regulation of transformer, losses &efficiency, condition for maximum efficiency, Allday efficiency, Efficiency curve, Sumpner's test, Auto transformer, Saving of conductor material, Parallel operation, Conditions, Parallel with equal and unequal voltage ratio. **3 Phase transformers:** Construction, connections, Scott connection, V-V Connection, Instrument transformers, Current transformers and potential transformers.	**8**	**18**
2.	**Induction Machines:** **3 Phase induction motor:** Construction, types, rotating magnetic field, principle of operation, slip, frequency of rotor current, rotor emf, rotor current, expression for torque, conditions for maximum torque, torque slip characteristics, starting torque in squirrel cage and slip ring motors, effect of change in supply voltage on torque, slip and speed , relation between full load torque and maximum torque, Power stages in induction motor, vector diagram and equivalent circuit, circle diagram, construction and calculation, speed control of 3 phase motor, starting methods for 3 phase induction motor. **Single phase motor:**	**10**	**22**

	Double revolving field theory, starting methods, no load and block rotor test, equivalent circuit, types of single phase motor		
3.	**Synchronous Machine:** Alternator,Basic principle, construction, pitch factor, distribution factor, emf equation, alternator on load, voltage regulation, synchronous impedance method, mmf method, ZPF method, parallel operation, synchronization of alternator. **Synchronous motor:** Basic principle, methods of starting, application.	**10**	**20**
4.	**DC Machines:** **DC Generator**: Construction features, emf equation of dc generator, methods of excitation, losses condition for maximum efficiency, armature reaction, interpoles and compensating winding, commutation, methods of improving commutation, characteristics of separately excited and self excited dc generator. **DC Motor:** Working principle, voltage equation, condition for maximum power, characteristics, operating characteristics of dc motor, torque developed, starting ,3 point and 4 point starter, speed control methods, swinburn's and break test of dc shunt motor.	**10**	**20**
5	**Basic of Power transmission and distribution** Operation of different power plants using block diagram-different terminologies like load factor, diversity factor, plant utilization factors etc. Classification of transmission lines, transmission line parameters, ABCD constants, Voltage regulation, Ferranti effect, efficiency of transmission line. 3-phase 3-wire and 3-phase 4-wire distribution system, feeders, distributors, main lines, comparison of various distribution systems, load power factor improvement techniques.	**10**	**20**
	Total	**48Hrs**	**100**

Reference Books:

1. Text of Electrical Technology;Vol -2; B. L. Theraja, and A. K. Theraja; S. Chand Publication
2. Electrical machines BY AshfaqHussain; Dhanpatrai and Co.
3. Principles of Electrical power systems by J. B. Gupta
4. Generalised theory of rotating machines By P S Bhimra

Course Outcome:

After learning the course the students should be able to :

- Understand working principle, performance, control and applications of AC, DC Machines and Transformer.
- Carry out basic experiments on AC, DC machine and Transformer.
- Identify, formulate and solve AC, DC machine and Transformer related problems.
- Understand the working and performance analysis of Transmission and Distribution of power.

List of Experiments:

1. To operate two single phase transformers of different KVA ratings in parallel and plot the variation of currents shared by each transformer versus load current.
2. To perform Open Circuit and Short circuit Test on a transformer and find its efficient and regulation.
3. Speed control of DC Shunt Motor using a) Armature control and b) field control methods

4. To obtain Magnetizing Characteristics, Internal & External Characteristic of Self Excited DC Shunt Generator. Also obtain the critical filed resistance of the machine from magnetizing Characteristics.
5. To conduct direct load test on a D.C. compound generator with a) Shunt field alone b) Cumulative and differential compounding for short and long shunt connections.
6. To obtain Speed-Torque characteristics of DC Series Motor
7. To obtain Speed-Torque characteristics of DC Shunt Motor.
8. To study different starters of D. C. motor.
9. To study different starters of three phase induction motor
10. To perform No load and Block rotor test on induction motor and plot equivalent circuit
11. To Study the effect of Inserting resistance on rotor of Slip ring induction motor.
12. To draw the V curves for synchronous machine
13. To find the voltage regulation of synchronous machine
14. To study capacitor start and capacitor run induction motor
15. Find Voltage regulation and efficiency of Medium transmission line
16. Find Voltage regulation and efficiency of Long transmission line
17. To study various power factor improvement methods
18. To study the block diagram of various power plants

Design based Problems (DP)/Open Ended Problem:

1. To find the applications of various single phase/ three AC and DC motors
2. Design capacitor bank to improve the load power factor
3. Design electrical power distribution system to achieve priscribed voltage regulation

Major Equipments:

Transformer, Single phase and three phase induction motor, synchronous machine,

List of Open Source Software/learning website:

Web-based tools for design:

- http://www.fairchildsemi.com/support/design-tools/power-supply-webdesigner/
- http://www.ti.com/lsds/ti/analog/webench/overview.page

Circuit Lab:

- https://www.circuitlab.com/editor/

Open source Math Tools:

- http://maxima.sourceforge.net/
- http://www.sagemath.org/
- http://www.scilab.org/
- http://www.gnu.org/software/octave/

Learning website

- http://www.electrical-engineering-portal.com/
- http://nptel.iitm.ac.in/courses.php

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS (10) / ELECTRONICS & COMMUNICATION (11) /COMPUTER ENGINEERING (07) / INFORMATION TECHNOLOGY (16) / INFORMATION & COMMUNICATION TECHNOLOGY (32)

DIGITAL ELECTRONICS

SUBJECT CODE: 2131004

B.E. 3RD SEMESTER

Type of course: Analysis and Design of Digital Circuits

Prerequisite: Basic Electronics and Number Systems

Rationale: The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors. The students need to know combinational and sequential circuits using digital logic fundamentals. This is the first course by which students get exposure to digital electronics world.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Binary Systems and Logic Circuits: The Advantage of Binary, Number Systems, The Use of Binary in Digital Systems, Logic Gates, Logic Family Terminology.	**3**	**5**
2	Boolean Algebra and Mapping Methods: Boolean Algebra, Karnaugh Maps, Variable Entered Maps, Realizing Logic Function with Gates, Combinational Design Examples.	**7**	**15**
3	Logic Function Realization with MSI Circuits: Combinational Logic with Multiplexers and Decoders, Standard Logic Functions with MSI Circuits, Design Problem Using MSI Circuits.	**7**	**15**
4	Flip Flops, Counters and Registers: Flip Flops and its Applications	**8**	**15**
5	Introduction to State Machines: The Need for State Machines, The State Machine, Basic Concepts in State Machine Analysis.	**3**	**5**
6	Synchronous State Machine Design: Sequential Counters, State Changes Referenced to Clock, Number of State Flip-Flops, Input Forming Logic, Output Forming Logic, Generation of a State Diagram from a Timing Chart, Redundant States, General State Machine Architecture	**8**	**15**
7	Asynchronous State Machines: The Fundamental-Mode Model, Problems of Asynchronous Circuits Basic Design Principles, An Asynchronous Design Example.	**7**	**15**
8	Logic Families: Transistor-Transistor Logic(TTL), Emitter-Coupled Logic(ECL), MOSFET Logic, TTL Gates.	**4**	**5**
9	Programmable Logic Devices: Introduction to Programmable Logic Devices,	**5**	**10**

	Read-Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Combinational PLD-Based State Machines, State Machines on a Chip.		
Total		**52**	

Reference Books:

1. Digital Logic & State Machine Design By David J. Comer, Third Indian Edition, Oxford University Press
2. Digital Logic and Computer Design By M Morris Mano, Fourth Edition, Prentice Hall Publication
3. Digital Principles and Applications By Malvino & Leach, Seventh Edition, McGraw-Hill Education
4. Modern Digital Electronics By R.P.Jain, Fourth Edition, Tata McGraw-Hill Education.
5. Digital Electronics: Principles and Integrated Circuits By A.K. Maini, Wiley India Publications
6. Digital Design M. Morris Mano and Michael D. Ciletti, Pearson Education
7. Digital Electronics and Design with With VHDL, Volnei A. Pedroni, Elsevier (Morgan Kaufmann Publishers)

Course Outcome:

After learning the course the students should be able to explain about digital number systems and logic circuits. The student should be able to solve logic function minimization. The students should be able to differentiate between combinational and sequential circuits such as decoders, encoders, multiplexers, demultiplexers, flip-flops, counters, registers. They should be able to design using FSM. In the laboratory, they should be able to verify the functions of various digital integrated circuits. The students should be able state the specifications of logic families. They should be able to start writing HDL codes for various digital circuits. The student should be able to compare the design using digital circuits and PLDs. At the end they should be able to develop a course project using digital integrated circuits.

List of Experiments:

1. Getting familiar with various digital integrated circuits of different logic families. Study of data sheet of these circuits and see how to test these circuits using Digital IC Tester.
2. Digital IC Testers and Logic State Analyzer as well as digital pattern generators should be demonstrated to the students.
3. Configure diodes and transistor as logic gates and Digital ICs for verification of truth table of logic gates.
4. Configuring NAND and NOR logic gates as universal gates.
5. Implementation of Boolean Logic Functions using logic gates and combinational circuits.
   Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
6. Study and configure of various digital circuits such as adder, subtractor, decoder, encoder, code converters.
7. Study and configurations of multiplexer and demultiplexer circuits.
8. Study and configure of flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
9. Perform an experiment which demonstrates function of 4 bit or 8 bit ALU.
10. Introduction to HDL. Use of HDL in simulation of digital circuits studied in previous sessions using integrated circuits. Illustrative examples using FPGA or CPLD boards.

Design based Problems (DP)/Open Ended Problem:

1. Design of combinational lock circuits with varying number of bits (For example 4, 8 …..)
2. Design of various types of counters.
3. Design of Arithmetic and Logic Unit using digital integrated circuits.
4. Design of digital integrated circuit tester

5. Measurement of logic family specifications.
6. Design project for example digital clock, digital event counter, timers, and various multi-vibrator Circuits, small processor, ports or scrolling display.

A student and faculty may choose any other such problem which includes the concept used in the course.

Major Equipments:

1. Pattern Generators
2. Logic State Analyzers
3. Digital Storage Oscilloscopes
4. Digital Integrated Circuits Tester.
5. Complete Bread Board Systems, switches and I/O indicators, multimeters, pulse, square wave generators and display faciltity.

List of Open Source Software/learning website:

1. Web packages for HDL, GHDL, FreeHDL
2. PSpices and NGSpice
3. Xcircuit and Scilab
4. NPTEL website and IITs virtual laboratory

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GUJARAT TECHNOLOGICAL UNIVERSITY

ELECTRONICS (10) / ELECTRONICS & COMMUNICATION (11) / INSTRUMENTATION & CONTROL (17)

ELECTRONIC DEVICES AND CIRCUITS

SUBJECT CODE: 2131006

B.E. 3RD SEMESTER

Type of course: Basic device modeling and circuit design

Prerequisite: Basic knowledge of electronic components and laws such as KCL, KVL, etc.

Rationale: This course provides a platform for students to understand working of active devices such as Diode, BJT, and MOSFET, JFET and circuits and systems like amplifier, oscillator and feedback circuits. Students are also taught to analyze and design circuits using these active devices. This is one of the foundation courses which are required for students to understand working of complex electronic circuits and systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightag
1	**Semiconductors:** Conductors, Semiconductors, Silicon Crystal, Intrinsic Semiconductors, Two Types of Flow, Doping a Semiconductor, Two Types of Extrinsic Semiconductors, The Unbiased Diode, Forward Bias, Reverse Bias, Breakdown, Energy Levels, The energy Hill, The Barrier Potential and Temperature , Reverse-Biased Diode	**02**	3.84
2	**Diode Theory:** Basic Ideas, The Ideal Diode, The Second Approximation, The Third Approximation, Reading a Data Sheet, How to Calculate Bulk Resistance, DC Resistance of a Diode , Load Lines	**03**	5.76
3	**Diode Circuits:** The Half Wave Rectifier, The Transformer, The full Wave Rectifier, The Bridge Rectifier, The Choke –Input Filter, The Capacitor –Input Filter, Peak , Inverse Voltage and Surge Current, Clipper and Limiters, Clampers, Voltage Multipliers	**05**	9.6
4	**Special Purpose Diode:** The Zener Diode, The Loaded Zener Regulator, Second Approximation of a Zener Diode, Zener Drop Out Point, Reading a Data Sheet, Load Lines, Optoelectronics Devices, The Schottky Diode, The Varactor, Other Diodes	**04**	7.68
5	**Bipolar Junction Transistor**: The Unbiased Transistor, The Biased Transistor, Transistor Currents, The CE Connection, The base Curve, Collector Curves, Transistor Approximations, Reading Data Sheets	**04**	7.68
6	**Transistor Fundamentals:** Variation in Current gain, The Load Line,	**04**	7.68

	The Operating Point, Recognizing saturation, The Transistor Switch, Emitter Bias, LED Drivers, The effect of small Changes, More Optoelectronics Devices		
7	**Transistor Biasing:** Voltage Divide Bias, Accurate Voltage Divide Bias (VDB) Analysis, VDB Load line and Q-Point, Two Supply Emitter Bias, Other Types of Bias, PNP Transistors.	**05**	9.6
8	**AC Models:** Base-Biased Amplifier, Emitter-Biased Amplifier, Small-Signal operation, AC Beta, AC Resistance of the Emitter Diode, Two Transistor models, Analyzing an Amplifier, AC Quantities on the data sheet	**04**	7.68
9	**Voltage amplifier:** Voltage gain, The loading effect of input impedance, multistage amplifiers, swamped amplifier, two-stage feedback, **Frequency Effects:** Frequency Response of an Amplifier, Decibel Power gain, Decibel voltage gain, Impedance matching, The Miller Effect	**05**	9.6
11	**CC and CB Amplifier:** CC Amplifier, Output Impedance, Cascading CE and CC, Darlington Connections, Voltage Regulation, The Common Base Amplifier	**04**	7.68
12	**Power Amplifiers:** Amplifier Terms, Two Load Lines, Class-A Operation, Class-B Operation, Class-B Push Pull Emitter Follower, Biasing Class B/AB Amplifiers, Class B/AB Driver, Class-C Operation	**04**	7.68
	JFETs AND MOSFETs: Basic Ideas, Drain Curves, Transconductance Curves, Biasing in Ohmic Region, Biasing in Active Region, Transconductance, JFET Amplifiers, JFET Analog Switch, Other JFET Applications, The Depletion Mode MOSFET,D- MOSFET Curves, Depletion Mode MOSFET Amplifier, The Enhancement Mode MOSFET	**04**	7.68
13	**Feedback Amplifier:** Introduction, The Basic concepts of Feedback, Effect Of Negative Feedback, Types Of Negative Feedback Connections, Method Of Identifying Feedback Topology and Feedback Factor , Stability Of Feedback Amplifier**.**	**04**	7.68
Total		**52**	

Reference Books:

1. Electronics Principles by Albert Malvino [seventh Edition]
2. Electronics Device and circuits by S Salivahanan and N Suresh Kumar, McGraw Hill Publication [Second Edition or Higher Edition].
3. Electronics Device and circuits by Jacob Milman and Christos C. Halkias, Tata Macgraw Hill Publication [Second Edition].
4. Basic Electronics devices and Circuits by Mahesh B Patil, PHI Learning PVT. Ltd.

Course Outcome:

1. To apply the principles of semiconductors devices.
2. To apply basic principle of diode and understand its second and third approximation.
3. To analyze the rectifier circuits, clippers and clamper circuits using diodes.
4. To analyze and study the various special purpose diodes such as zener diode, schottky diode, varactor diode and photo diode.
5. To study and understand the bipolar junction transistor.
6. To understand the fundamentals of transistor.
7. To study and understand the various biasing methods for transistor.
8. To study and analyze the various AC models.
9. To analyze various parameters of voltage amplifier.

10. To analyze the CC and CB Amplifier.
11. To study and understand the power amplifier.
12. To analyze the basic principle, operation and applications of JFET and MOSFET.
13. To study and understand the feedback topology of amplifier.

List of Experiments:

Sr No.	Name of the Experiment
1	Obtain I-V characteristic of Diode.
2	To measure ripple factor at the output of (a) Half wave rectifier with and without filter capacitor (b) Full Wave rectifier with and without filter capacitor (C) Bridge rectifier with and without filter capacitor.
3	To verify performance of various Clipper circuits.
4	To verify performance of various Clamper circuits.
5	Obtain I-V characteristic of Zener Diode.
6	Obtain I-V characteristic of photo diode.
7	To obtain characteristic of transistor as a switch circuit.
8	To obtain input and output characteristics and calculate gain of CE amplifier circuit.
9	To obtain input and output characteristics and calculate gain of CB amplifier circuit.
10	To obtain frequency response of single stage transistor amplifier.
11	To obtain the transfer characteristics of FET.
12	To test the performance of negative feedback amplifier and compare gain, BW with amplifier without feedback.
13	To study the effect of (a) voltage series feedback on two stage amplifier (b) current series F/B on single stage CE amplifier.
14	Determine the efficiency of push pull power amplifier
15	Build/test transformer coupled class-A Power amplifier.

Design based Problems (DP)/Open Ended Problem:

1. Design a Half wave rectifier which has low ripple value.
2. Design a Full wave rectifier which has low ripple value.
3. Design a Full wave bridge rectifier which has low ripple value.
4. Design a regulated power supply using Zener diode.
5. Make a mini project on automatic washroom light on-off.
6. ON/OFF light bulb at 230V using relay and transistor as a switch.
7. Design a CE, CC, and CB amplifier.
8. Design any application using Darlington pair.
9. Design audio amplifier using any type of power amplifier.
10. Design an inverter with n-type enhancement MOSFET and draw its VTC characteristics using NgSpice.
11. Simulate experiments using available Electronic Design Automation Tools like Circuit maker, Tina, Multisim, Electronic work bench etc.
12. Seminar/Mini Project

Major Equipments:

C.R.O., Function Generator, Power Supply, Multimeter, Digital Storage Oscilloscope, Experimental Trainer Kits, Bread Board, General Purpose PCB

List of Open Source Software/learning website:

Ng-spice/Multisim
www.nptel.com

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