Ref: UPL University /SRICT/BOS/EE/2021-22/02
Date: 17-03-2022

Proposed Teaching Scheme for Second Year Bachelor of Electrical Engineering

Semester-III (Electrical Engineering) Proposed Structure

Sr. No.	Category	Course Code	Course Name	Hours Per Week			Total Hours	Credits	E	M	I	V	Total
				L	T	P							
1	Humanities & Social Science	MH2201	Communication Skills in English	2	0	2	4	3	70	30	20	30	150
2	Basic Science	MH2202	Mathematics-III	3	2	0	5	5	70	30	50	0	150
3	Engineering Science	EE2201	Digital Electronics	3	0	2	5	4	70	30	20	30	150
4	Professional Core Course	EE2202	Electrical Measurements and Measuring Instruments	3	0	2	5	4	70	30	20	30	150
5	Professional Core Course	EE2203	Electrical Circuit Analysis	4	0	2	6	5	70	30	20	30	150
6	Professional Core Course	EE2204	Electrical Machines-I	3	0	2	5	4	70	30	20	30	150
7	Internship	MH2205	In-Plant Training	0	0	0	0	1	0	0	50	0	50
Total							**31**	**26**	**420**	**180**	**200**	**150**	**950**

Semester-IV (Electrical Engineering) Proposed Structure

Sr. No.	Category	Course Code	Course Name	Hours Per Week			Total Hours	Credits	E	M	I	V	Total
				L	T	P							
1	Humanities & Social Science	MH2204	Universal Human Values	3	0	0	3	3	70	30	0	0	100
2	Basic Science	EE2205	Analog Electronics	2	0	2	4	3	70	30	20	30	150
3	Professional Core Course	EE2206	Control System Engineering	3	0	2	5	4	70	30	20	30	150
4	Professional Core Course	EE2207	Electromagnetic Field Theory	3	0	0	3	3	70	30	0	0	100
5	Professional Core Course	EE2208	Electrical Power System-I	3	0	2	5	4	70	30	20	30	150
6	Professional Core Course	EE2209	Electrical Machines -II	3	0	2	5	4	70	30	20	30	150
7	Professional Elective-I	--	Professional Elective-1	2	0	2	4	3	70	30	20	30	150
Total							**29**	**24**	**490**	**210**	**100**	**150**	**950**

Professional Elective-1	
Course Code	**Course Name**
EE2210	Electrical Estimation Costing and Wiring
EE2211	Renewable Energy Sources

A. Code and Abbreviations:

Code	Abbreviation
L	Lecture
T	Tutorial
P	Practical
E	Theory External Examination Marks
M	Theory Internal Examination Marks
I	Practical Internal Examination Marks
V	Practical External Examination Marks

Bachelor of Engineering
Course Code: MH2201
Course Name: Communication Skills in English

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - III

Type of course: Language and Communication

Prerequisite: Zeal to learn the Language

Rationale: The rationale of the curriculum is to help students to express their original ideas in English and also develop interest in language and literature with a focus on comprehension, and reading, speaking and writing skills

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	Dynamics of Communication: Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations	6
2	Technical Writing: Report writing Technical proposal Technical description Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter) Agenda of meeting, Minutes of meeting Resume writing	7
3	Technical Communication: Public speaking, Group discussion, Presentation strategies, Interview skills, Negotiation skills ,Critical and Creative thinking in communication	7
	SECTION-B	
4	T Ethics in Engineering: Scope of engineering ethics, Accepting and sharing responsibility , Resolving ethical dilemmas, Making moral choices	**6**

Bachelor of Engineering
Course Code: MH2201
Course Name: Communication Skills in English

5	Etiquettes: Telephone etiquettes for foreign business trips, Etiquettes for small talks, Respecting privacy ,Learning to say NO, Time management, Scope of engineering ethics, Accepting and sharing responsibility ,Resolving ethical dilemmas ,Making moral choices	**7**
6	Self-development and Assessment: Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream.	**6**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	15	15	15	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Language Laboratory Activities:

Sr. no	**Practical/ Exercise**	**Apprx. Hours required**
1	Role Play	02
2	Letter writing: Formal	02
3	Group Discussion	02
4	Presentations	02
5	Book Review(Preferably related to self-development)	04
6	Mock Interview	02
7	Report writing	02
8	Case studies related to unit 4, 5 and 6	02
9	Conducting meeting with Agenda	02
10	Minutes of Meeting	02

Bachelor of Engineering
Course Code: MH2201
Course Name: Communication Skills in English

Reference Books:

1. Raman and Sharma, Technical Communications, OUP, New Delhi, 2017
2. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018
3. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014
4. Mohapatra and Sreejesh S., Case Studies in Business Ethics and Corporate Governance, Pearson, UP, 2013
5. Ramesh and Ramesh, The Ace of Soft Skills, Pearson, UP, 2019
6. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009
7. Open Sources: https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases

Course Outcomes: After Learning this course, students will be able to:

Sr. No.	CO statement
CO-1	Define and describe dynamics of verbal and non-verbal aspects of communication.
CO-2	Associate with various formal documents of technical and professional communication
CO-3	Interpret communication of diverse formal situations taking place in organizations.
CO-4	Illustrate and examine the knowledge of ethical aspects of engineering
CO-5	Establish and explain social and professional etiquettes.
CO-6	Recommend self -development and self - assessment.

List of Open Source Software/learning website:

Open Sources: https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases

(Established under Gujarat Private Universities Act, 2009)

Bachelor of Engineering
Course Code: MH2202
Course Name: Mathematics-III

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - III

Type of course: Engineering Science

Prerequisite: Algebra, Trigonometry, Geometry, Differentiation, Integration

Rationale: The study to compute area, volume and Transformation of functions

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	5	70	30	0	50	150

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Fourier Series:** Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion.	5
2	**Laplace Transforms**: Definition of the Laplace transform, Linearity, Shifting theorems, Laplace transformation of elementary function, basic properties of Laplace transformation, Differentiation of Laplace transformation(multiplication by t), Integration of Laplace transformation(division by t), Laplace transformation of derivatives and integrals, unit step function. Evaluation of integrals using Laplace transformation.	10
3	**Curve Sketching**: Curve sketching in Cartesian Co-ordinates and Polar co-ordinates, Relation between Polar and Cartesian Co-ordinates.	5
	SECTION-B	
4	**Double integral and it's applications of:** over rectangular and general regions, properties of double integrals, Change of order, in polar coordinates, change of variables, Area by double Integrals	5

Bachelor of Engineering
Course Code: MH2202
Course Name: Mathematics-III

5	**Inverse Laplace transformation and its application:** Properties of inverse Laplace transformation, shifting theorem, multiplication and division by differentiation and integration of Laplace transformation. Convolution theorem, inverse Laplace transformation using partial fraction, solution of linear differential equation.	10
6	**Fourier integral:** Sine and cosine integral, even and odd functions	4

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**30**	**10**	**0**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. Advanced Engineering Matheamtics by Ravish Singh and Mukul Bhatt.MC Graw Hill Education Pvt Ltd.

2. Engineering Mathematics Vol 2, by Baburam, Pearson

Reference Books:

1. Thomas' Calculus, Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
2. Advanced Engineering Mathematics (8th Edition), by E. Kreyszig, Wiley-India (2007).
3. R. V. Churchill and J. W. Brown, Fourier series and boundary value problems (7th Edition), McGraw-Hill (2006).

List of Tutorial:

1. Tutorial-1 (Fourier Series)

Bachelor of Engineering
Course Code: MH2202
Course Name: Mathematics-III

2. Tutorial-2 (Fourier Series)
3. Tutorial-3 (Laplace Transform)
4. Tutorial-4 (Laplace Transform)
5. Tutorial-5 (Curve sketching)
6. Tutorial-6 (Double Integral and its application)
7. Tutorial-7 (Double Integral and its application)
8. Tutorial-8 (Fourier Integral)
9. Tutorial-9 (Inverse Laplace Transformation)
10. Tutorial-10 (Inverse Laplace Transformation)

Course Outcomes: After learning this course students will be able to

Sr. No.	CO statement
CO-1	**Define** Laplace and Inverse Laplace transformation, Fourier Series and Integral.
CO-2	**Solve** differential equations Using Laplace transform and inverse Laplace Transformation.
CO-3	**Sketch** the Cartesian and Polar graphs.
CO-4	**Calculate** the area using Double integrals
CO-5	**Construct** a Fourier integral to evaluate the Integral.
CO-6	**Evaluate** the sum of series using Fourier series

List of Open Source Software/learning website:

- https://nptel.ac.in/
- http://www.sosmath.com/

Bachelor of Engineering
Course Code: EE2201
Course Name: Digital Electronics

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Engineering Science

Prerequisite: Fundamental knowledge of Basic Electronics

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				Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)		
3	0	2	4	70	30	30	20	150

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
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
2	**Boolean Algebra with Logic Gates:** Boolean Algebra, Realizing Logic Function with Gates, Combinational Design Examples	5
3	**Combinational Digital Circuits:** K-map representation in 2-Variable K-map & 3-Variable K-map, simplification of logic functions using K-map. Half & Full adder, Half & Full Subtractor, BCD-Excess 3 Conversion, 2 to 4 line & 3 to 8 line decoder, 4 to 2 line Encoder, 8 to 3 line Encoder, 4x1 Multiplexer, 1x4 De-multiplexer	10
	SECTION-B	
4	**Sequential circuits and systems:** The clocked SR flip flop, J- K-T and D types flip-flops, applications of flip-flops, shift registers, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, asynchronous sequential counters.	10
5	**A/D and D/A Converters:** weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs,	5

	sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs	
6	**Programmable Logic Devices:** Introduction to Programmable Logic Devices, Read-Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Combinational PLD-Based State Machines, State Machines on a Chip.	**3**

Text Books:

1. Principles of Electronics**,** V K Mehta, S. Chand, 2004 or latest
2. Fundamentals of Digital Circuits by Anand Kumar, PHI, Learning, 4th Edition.
3. Modern digital electronics by R. K. Jain.

Reference Books:

1. Digital Logic and Computer Design By M Morris Mano, Fourth Edition, Prentice Hall Publication

List of Practical: (Min. 10 Practical should be performed):

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.

Bachelor of Engineering
Course Code: EE2201
Course Name: Digital Electronics

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	To memorize the functioning and selection of Digital components.
CO-2	To Discuss the working of different digital circuits.
CO-3	To implement Digital Combinational & Sequential logic circuits.
CO-4	To Experiment the Digital circuits.
CO-5	To Evaluate the various parameters Digital Circuits.
CO-6	To Design the different types of Digital circuits.

List of Open Source Software/learning website:

1) Psim software
2) MultiSim software
3) website : https://www.vlab.co.in

References used for designing a course:

1. UGC Syllabus Booklet
2. GTU
3. PDPU

(Established under Gujarat Private Universities Act,

Bachelor of Engineering

Course Code: EE2202

Course Name: Electrical Measurements and Measuring Instruments

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - IV

Type of course: Professional Core Course

Prerequisite: Basic Electrical Engineering

Rationale: Electrical installations ranging from residential consumers to huge industrial estates all are equipped with measuring instruments. In view of this, study of principles of Electrical measurements and measuring instruments becomes mandatory for all electrical engineers. This subject deals with principles of measurements, analog and measuring instruments as well as transducers.

Course Objectives:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Concepts of Measurement :** Philosophy Of Measurement- Methods of Measurement, Measurement System, Classification of instrument system, Methods of Measurement, Static Characteristics like accuracy, precision, sensitivity, linearity, range, reproducibility, drift, threshold, dead zone etc. Dynamic Characteristics like speed of response, fidelity overshoot etc., Introduction to measurement of speed, frequency and power factor. Measurement Standards Errors in measurement, Basic statistical evaluation of measurement data and errors - mean, standard deviation,	**08**

	Six sigma estimation.	
2	**Transducers and Sensors :**Definition, different types of transducers, criteria for selection, general characteristics and dynamic characteristics, transducers for measurement of temperature ((Thermocouple and RTD), transducers for measurement of pressure, strain, transducers for measurement of displacement, speed, torque, Hall Effect transducer Sensors – basic concept – Speed and position sensors, Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.	**06**
3	**Display devices:** Display methods, recorders: Display methods and devices, different types of recorders, galvanometric recorders, pen driving system, magnetic recorders, digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only) , Characteristics of digital display, DVM and Digital multi meter, Clamp on meter, Megger.	**04**
SECTION-B		
4	**Measurement of R, L and C :** Different methods of measuring low, medium and high resistances, Wheatstone Bridge, Measurement of inductance & capacitance with the help of AC Bridges (Hays Bridge, Schering Bridge, Maxwell bridge, Anderson Bridge), LCR meter - working principle with block diagram	**08**
5	**Measurement of Parameters :** Measurement of resistance, , Extending the range of meters - Shunts, Potential divider, Instrument Transformer and their applications in the extension of instrument range, Measurement of voltage, current, power, energy, power factor and frequency (constructions and operating principles of corresponding instruments)	**06**
6	**Digital Measurement of Electrical Quantities:** Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter. Digital recorders, Digital Storage Oscilloscope - Block Diagram, theory and applications, Power scope.	**04**

Text Books:

1. Gupta J. B., "A Course in Electronics and Electrical Measurements and Instrumentation", S.K. Kataria & Sons

2. A.K.Sawhney, "Electrical and Electronic Measurements and Instrumentation", DHANPAT RAI & CO.

Reference Books:

1. Golding & Widis, 'Electrical Measurement and Measurement instrument', Wheelar Books

2. D. Patranabis, 'Sensors & Transducers', PHI.

3. H. S. Kalsi, " Electronic Instrumentation", Tata McGraw-Hill Education.

4. A.J. Bouwens, 'Digital Instrumentation', Tata Mc-Graw hill.

List of Practical: (Min. 10 Practical should be performed):

1. Operation of Wheatstone Bridge &measurement of unknown resistance using Wheatstone Bridge.
2. Investigation of source of error in measurements &observation of the value of statistical analysis.
3. Measurement of unknown value of low resistance by balancing the Kelvin's double bridge.
4. Measurement of unknown value of voltage, current & resistance using potentiometer.
5. Measurement of the value of unknown inductance using Anderson Bridge.
6. Measurement of the value of unknown inductance using Maxwell's Inductance.
7. Measurement of the value of unknown capacitance using Maxwell's Capacitance Bridge.
8. Measurement of energy and calibration of single phase energy meter with wattmeter.
9. Introduction to transducers and sensors.
10. Measurement of power &power factor in 3-φ load by 2- wattmeter method.

Course Outcomes:

Students will be able to:

Cos	CO statement
CO.1	Comprehend the basics of electrical measurements.
CO.2	Explain basic principle, working, characteristics and applications of the various measuring instruments and transducers and sensors.
CO.3	Apply AC and DC bridges for measurement of electrical parameters like resistance, inductance and capacitance.
CO.4	Prepare the specifications of required measurement systems to be used for measurement of parameters for a specified application.
CO.5	Application of DSO
CO.6	Prepare the measurement of DVM, digital multimeter, Megger, Clamp onmeter

List of Open Source Software/learning website:

- http://www.scilab.org/

- http://www.vlab.co.in/

References used for designing a course:

1. SVNIT
2. GTU
3. PDEU

Bachelor of Engineering
Course Code: EE2203
Course Name: Electrical Circuit Analysis

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - III

Type of course: Professional Core Course

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

Rationale: Electrical circuits are the integral elements of the power system. Analysis and response of electrical circuits for various inputs is the basic requirement to understand the behavior of the system. The responses for various inputs are in turn helpful to design, implement, operate and control a network effectively. This subject is intended to provide the basic insight into the theory and problems related to electrical circuit analysis.

Course Objectives:
Electrical Circuit Analysis is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes Theorems for AC, Three phase circuits, Transient analysis, Laplace transforms and network topology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Network Concepts** Network Element Symbols & Conventions, Active Elements, Current & Voltage Conventions, Loops & Meshes, Nodes, Mutually Coupled Circuits & Dot Conventions in coupled circuits, Ideal Transformer.	4

2	**Network Analysis Techniques and Theorems** Mesh Currents Analysis, Node Voltage Analysis, Linearity & Superposition, Independent Sources & their Transformations, Circuit Analysis Based on Thevenin's Theorem, Norton's Theorem, Millman's Theorem, Reciprocity Theorem & Maximum Power Transfer Theorem, Duality & Concept of Dual Network.	**8**
3	**Solution of First and Second Order Networks** Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.	**6**
SECTION-B		
4	**Laplace Transform Analysis and Circuit Applications** Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions.	**8**
5	**Sinusoidal Steady State Analysis** Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits.	**4**
6	**Two Port Network and Network Functions** Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.	**6**

Text Books:

1. U. A. Bakshi and A. V. Bakshi, "Electrical Circuit Analysis", Technical Publication, 2021
2. U. A. Patel, "Electrical Circuit Analysis", Mahajan Publishing House

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. K.S.Suresh Kumar, "Electric Circuit Analysis", Pearson Publications, 2013.
3. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
4. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication

Bachelor of Engineering
Course Code: EE2203
Course Name: Electrical Circuit Analysis

List of Practical: (Min. 10 Practical should be performed):

1. To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2. To study and verify Node Voltage analysis for the given resistive network.
3. To study and verify Mesh analysis for the given resistive network.
4. To verify superposition theorem experimentally for a given resistive circuit consisting two independent sources.
5. To verify Thevenin's theorem experimentally for a given circuit.
6. To verify Norton's theorem experimentally for a given circuit.
7. To verify maximum power transfer theorem experimentally for a given circuit.
8. To verify the reciprocity theorem.
9. To measure and calculate RC time constant for a given RC circuit.
10. To measure and calculate RC time constant for a given RL circuit.
11. To measure and calculate Z-parameters for a given two-port system.
12. To measure and calculate Y-parameters for a given two-port system.

Course Outcomes:
Students will be able to:

COs	CO statement
CO.1	**Identify** the use of circuit law's and methods for circuit analysis.
CO.2	**Understand** about the electrical networks, network elements, network analysis using Mesh current & Nodal voltage method.
CO.3	**Apply** network theorems for the analysis of electrical circuits.
CO.4	**Explain** the transient and steady-state operation of electrical circuits.
CO.5	**Reframe** the circuit analysis with Laplace Transform.
CO.6	**Write** the behavior of two port circuit.

List of Open Source Software/learning website:

- E-materials available at the website of NPTEL- http://nptel.ac.in/

References used for designing a course:

1. AICTE Model Curriculum-Jan 2018
2. PDU
3. GTU

Bachelor of Engineering
Course Code: EE2204
Course Name: Electrical Machines-I

Shroff S.R. Rotary Institute of Chemical Technology

Semester: III

Type of course: Professional Core Course

Prerequisite: Fundamentals of Electrical Engineering

Rationale: Electricity machines play a vital role in industries, agriculture, irrigation, domestic and almost all sectors of society. Static AC and rotating DC machines are utilized in by industries for various types of applications. This course deals with basic principles of DC machines and Transformers.

Course Objectives:

1. To create awareness about the basic principles, fundamental concepts, working and operating characteristics of electrical machines, such as D.C. Machines & Transformers.
2. To understand the operating characteristics and testing methods for D.C. Machines & Transformers.
3. To understand the performance analysis of different types of DC machines & Transformers
4. To have a sound knowledge about the different applications of DC machines & Transformers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Principles Of Electromechanical Energy Conversions:** Introduction, Principle of Singly Excited & Doubly Excited Systems, Electromagnetic & Reluctance Torques, Physical Concept of Force & Torque Production, Concept of General Terms Pertaining to Rotating Machines, Generated EMF in Full Pitched & Short Pitched Winding, Pitch & Distribution Factors, MMF of a Coil, Energy Stored in Magnetic Field,	03

	Torque in Machines with Cylindrical Air-Gap.	
2	**DC Machines:** **DC Motors:** Working principle of DC motor, back emf, Classification of DC Motors- Series, Shunt and Compound DC motors, Torque equation for DC motor, Performance characteristics of DC Series, Shunt and Compound motor, Speed control of D.C. motor, Need DC motor starters, Construction and working of DC motor starters, Numerical. **DC Generators:** Working Principle of DC Machines, Classification of DC Generators, Construction and materials used for various parts of DC generator, Functions of various parts of DC generator: Methods of excitation- separately and self-excited – shunt, series, compound, EMF equation of DC generator, Simplex lap and wave winding, Characteristics of various types DC generators, Efficiency and losses of DC Generator, Losses and efficiency, Power flow diagram, Parallel operation, Applications of DC generators, Effects of armature reaction - demagnetizing & cross magnetizing ampere-turns, compensating windings, inter poles, commutation and methods to improve commutation, Numerical.	**12**
3	**Testing of DC Machines:** Brake Test, Swinburne's Test, Regenerative/Hopkinson's Test, Retardation/Running Down Test, Field's Test for DC Series Motors, Numerical.	**03**
	SECTION-B	
4	**Single Phase Transformers:** Single phase transformer: Working principle, construction, materials used for different parts, EMF equation and transformation ratio, Core and shell type of transformers, Phasor diagram for load and different types of loads, Equivalent circuit of single phase transformer, Equivalent circuit of single phase transformer, Losses in transformer: Iron loss, Copper loss, Hysteresis loss and eddy current loss, Efficiency Condition for maximum efficiency of single phase transformer, Voltage regulation, Numerical	**07**
5	**Testing of Single Phase Transformers:** Direct load test, OC and SC test and Sumpner Test along with connection diagrams, efficiency and regulation of transformer, Derivation of equivalent circuit and its related parameters, Need of parallel operation, essential and desirable conditions for parallel operation, Need of parallel operation, essential and desirable conditions for parallel operation, Construction and working of autotransformer and welding transformer	**04**
6	**Three Phase Transformers:**	**07**

	Comparison of three phase transformer with bank of three single phase transformers, Arrangement of Core and windings in transformer, use of tap changer. Types of losses in transformers, Construction - Accessories of 3 phase transformer: Main tank, bushings, conservator with breather, oil level gauge, radiators, Buchholz relay, explosion vent, temperature indicators, junction box, Star delta connections and vector groups, Cooling of transformer: Natural cooling, Forced cooling, Parallel operation – Essential and desirable Conditions, Maintenance of different types of transformers, Dry type Transformer-Introduction, Safety Precautions.	

Text Books:

1. P.S. Bhimbra, Electrical Machinery, Khanna Publishers.
2. J. B. Gupta, Electrical Machines, S. K. Kataria & Sons, New Delhi.

Reference Books:

1. Theraja, B.L., Electrical Technology Vol-II, S. Chand, New Delhi.
2. Nagrath I J and Kothari D P, Electric Machines, Tata McGraw Hill.
3. MG Say, Theory, Performance & Design of A.C. Machines, CBS Publishers.

List of Practical: (Min. 10 Practical should be performed):

1. To obtain Magnetizing Characteristics, Internal & External Characteristic of Self Excited DC Shunt Generator. Also obtain the critical field resistance of the machine from magnetizing Characteristics.
2. 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.
3. To obtain Speed-Torque characteristics of DC Series Motor and DC Shunt Motor.
4. To determine the efficiency of two similar shunt machines by regenerative method. (Hopkinson's Test.)
5. To perform field test on identical D.C. series machines.
6. To determine the various losses in a D.C. machine and separation of its core losses.
7. To perform direct load test on a D.C. shunt motor and plot variation of (a) Input current (b) Speed(c) Torque (d) Efficiency versus output power.
8. To separate hysteresis and eddy current losses of a single phase transformer at rated voltage, frequency by conducting no load tests at different frequencies keeping V/f constant.
9. 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.

10. To conduct Sumpner test on two identical single phase transformers and determine their efficiency at various loads.
11. To perform Swinburne's test on DC shunt motor to find out its efficiency.
12. Speed control of DC Shunt Motor using a) Armature control and b) field control methods.

Course Outcomes:

Students will be able to:

Cos	CO statement
CO.1	Describe the basic energy conversation principle in electrical machine field, working principle, performance, control and applications of DC Machines and Transformer.
CO.2	Illustrate the operating range and efficiency for each machine running under different operating conditions.
CO.3	Demonstrate the connection diagram, test and conduct performance experiments on DC machine and Transformer.
CO.4	Analyze, Identify, formulate and solve DC machine and Transformer related problems.
CO.5	To motivate the student towards designing of the machines by providing them Design based problems that they can enhance the real application of machine.
CO.6	Evaluate the performance knowledge of the students by giving them Analytical problems.

List of Open Source Software/learning website:

- http://www.scilab.org/
- http://www.vlab.co.in/

References used for designing a course:

1. NPTEL Course-Electrical Machines-I by Prof. Tapas Kumar Bhattacharya, IIT Kharagpur.
2. Electrical Machines-I, Pandit Deendayal Energy University.
3. Electrical Machines-I, Gujarat Technological University.

(Established under Gujarat Private Universities Act, 2009)

Bachelor of Engineering
Course Code: MH2204
Course Name: Universal Human Values

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Humanities, Social Science including Management courses (HSMC)

Prerequisite: None. Basics of Universal Human Values (desirable)

Rationale: Course helps the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to Value Education :** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity–the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity–Current Scenario, Method to Fulfill the Basic Human Aspirations.	8
2	**Harmony in the Family:** Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation.	5
3	**Harmony in the Nature/ Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all levels, The Holistic perception of Harmony in Existence.	7
	SECTION-B	

Bachelor of Engineering
Subject Code: MH2204
Subject Name: Universal Human Values

4	**Harmony in the Human Being :**Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	8
5	**Harmony in the Society:** Understanding Harmony in the Society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive human goals, Visualizing a universal harmonious order in society.	4
6	**Implications of the Holistic Understanding – A Look at Professional Ethics :**Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	7

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**20**	**10**	**10**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1.

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

Bachelor of Engineering
Subject Code: MH2204
Subject Name: Universal Human Values

Reference Books:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A.N. Tripathi,, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book)
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. F Schumacher, "Small is Beautiful".
6. Cecile Andrews, "Slow is Beautiful".
7. J C Kumarappa, "Economy of Permanence"
8. PanditSunderlal, "Bharat Mein Angreji Raj"
9. Dharampal , "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. Maulana Abdul Kalam Azad , "India Wins Freedom"
12. Romain Rolland, "Vivekananda" (English)
13. Romain Rolland, "Gandhi" (English)

Course Outcomes:

After learning this course students will be able to:

Sr. No.	CO statement
CO-1	Relate themselves with the surroundings (family, society, nature)
CO-2	Explain sustainable solutions with respect to problems, keeping in mind the correlation between human relationships and human nature.
CO-3	Apply what they have learnt, into various day to day schedule.
CO-4	Distinguish between ethical and unethical practices and start working out the strategy in order to materialize a harmonious environment in the work place.
CO-5	Justify their commitment with respect to their understanding regarding human values, relationship and society.
CO-6	Develop the understanding of the intricacy of the problem and design appropriate solution.

Bachelor of Engineering
Subject Code: MH2204
Subject Name: Universal Human Values

List of Open Source Software/learning website:

- https://www.uhv.org.in
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Bachelor of Engineering
Course Code: EE2205
Course Name: Analog Electronics

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Basic Science

Prerequisite: Fundamental knowledge of Basic Electronics

Rationale: Analogue electronic components and circuits are building blocks for any electronic device used in industries or in daily life. It is therefore necessary for electronics engineers to understand clearly the principles and functioning of the basic analogue components and circuits. This course will enable the students to understand the basics of construction, working, and applications of various types of electronic components such as JFET, MOSJFET and circuits such as feedback amplifier, oscillators, power amplifiers, operational amplifier, and timers using linear ICs. Practical exercises of this course would enable students to maintain such circuits and in turn maintain equipment having such circuits. This course is therefore one of the basic core courses which is must for every electronic engineer and hence should be taken very sincerely by students

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)		
2	0	2	4	70	30	30	20	150

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Field Effect Transistor:** Explain construction and working principle of JFET. Describe configurations of JFET amplifier. Differentiate BJT and JFET. Explain construction and working principle of enhancement type MOSFET. Compare the working of JFET and MOSFET.	4
2	**Basics of Op-Amp:** Introduction Block diagram representation of a typical op-amp, Analysis op-amp ICC circuits, types, designations, packages, pin configurations and power supplies.	5
3	**Differential, multi-stage and operational amplifiers:** Differential amplifier; power amplifier, internal structure of an operational amplifier, Characteristics of an ideal op-amp, ideal op-amp v/s practical op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain	5

	bandwidth product).	
SECTION-B		
4	**Linear applications of op-amp:** Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.	**7**
5	**Nonlinear applications of op-amp:** Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.	**5**
6	**Voltage Regulator:** Three terminal regulator ICs: basic block schematic - 78 x x& 79 x x series - Adjustable output voltage regulator LM 317, LM 340 and LM 337 series power supply ICs. their use and basic design considerations for designing regulated power supplies.	**2**

Text Books:

1. Principles of Electronics**,** V K Mehta, S. Chand, 2004 or latest

Reference Books:

1. Op-Amps and Linear Integrated Circuits by Ramakant A Gayakwad, PHI, Learning, 4th Edition.

List of Practical: (Min. 10 Practical should be performed):

1. Study the different parameter of op-amp.
2. Comparison between different transistor configurations.
3. Frequency response of inverting amplifier and non-inverting amplifier.
4. Study of op-amp as inverting amplifier and non-inverting amplifier.
5. OPAMP circuits – Design and set up of inverter, scale changer, adder, non-inverting amplifier, integrator, differentiator, and comparator.
6. OPAMP circuits –integrator, differentiator, and comparator.
7. Phase shift and Wein's Bridge oscillator with amplitude stabilization using OPAMPs.
8. Waveform generation – Square, triangular and saw tooth wave form generation using OPAMPs.
9. Application of op-amp as low pass filter, high pass filter and band-pass filter.

Bachelor of Engineering
Course Code: EE2205
Course Name: Analog Electronics

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	To memorize the functioning and selection of OP-AMP and functioning of its components.
CO-2	To Discuss the working of different OP-AMP based circuits.
CO-3	To implement Op-amp based analog circuits.
CO-4	To Experiment the different Op-amp circuits.
CO-5	To Evaluate the various parameters of Analog Circuits.
CO-6	To Design the different types of Op-amp based circuits.

List of Open Source Software/learning website:

1) Psim software
2) MultiSim software
3) website : https://www.vlab.co.in

References used for designing a course:

1. UGC Syllabus Booklet
2. GTU

Bachelor of Engineering
Course Code: EE2206
Course Name: Control System Engineering

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Professional Core Course

Prerequisite: Fundamental knowledge of Electrical Engineering, Circuit and Network

Rationale: Automatic control of industrial processes is essential for increasing the output and in turn the profit of an industry. As a result, most of the companies are using automatic control of the machineries and processes. As an engineer, a student must know the basics of automatic control system. This subject is intended to supplement the basic skill of an engineer.

Course Objectives:

- To understand the modelling of linear-time-invariant systems using transfer function and state space representations.
- To understand the concept of stability and its assessment for linear-time invariant systems.
- To design simple feedback controllers.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	100

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Introduction to control problem** Industrial Control examples. Mathematical models of physical systems. Force Voltage and Force Current Analogy. Transfer function models of linear time-invariant systems. **Feedback Control:** Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram Reduction Technique, Signal Flow Graph.	6
2	**Time Response Analysis** Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Steady state	6

Bachelor of Engineering
Course Code: EE2206
Course Name: Control System Engineering

	error. Error coefficients, Sensitivity.	
3	**Concept of Stability** Types of stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.	**6**
	SECTION-B	
4	**Frequency-response analysis** Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.	**6**
5	**Introduction to Controller Design** Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.	**6**
6	**State variable Analysis** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems	**6**

Text Books:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. Richarc C. Drof and Robert H. Bishop , "Modern Control System" ,11th Edition Person Int.

Reference Books:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

List of Practical: (Min. 10 Practical should be performed):

1. Digitally simulate the time response characteristics of a linear system without non linearity's and to verify it manually
2. Transfer function, Block diagram reduction Technique
3. Determine Step response of 1st order system.
4. Determine Impulse response of 1st order system.
5. Time response of a given second order system with its damping frequency.
6. Determination of step & impulse response for a type '0', type '1', type '2' systems

7. Root locus for a given transfer function of the system using MATLAB.
8. Bode Plot for a given transfer function of the system using MATLAB.
9. Nyquist for a given transfer function of the system using MATLAB.
10. Transfer function from the state model.
11. Control the closed loop system using PID controller.

Course Outcomes:

Students will be able to:

COs.	**CO statement**
CO.1	Understand the modelling of linear-time-invariant systems using transfer function
CO.2	Analyze time response specifications and determine the (absolute) stability of a closed-loop control system
CO.3	Apply the concept of stability and its assessment for linear-time invariant systems.
CO.4	Evaluate the stability in frequency domain.
CO.5	Design controller as per given specifications using different techniques
CO.6	Understand the modelling of linear-time-invariant systems using State Space

List of Open Source Software/learning website: MATLAB, NPTEL, VLAB

References used for designing a course:

1. UGC Syllabus Booklet
2. GTU

Semester: - IV

Type of course: Professional Core Course

Prerequisite: Basic Electrical Engineering

Rationale: Study of electromagnetic fields is basically concerned with study of charges at rest and in motion. Electromagnetic principles serve as basic fundamentals for detailed and in-depth study of electrical engineering and are indispensable for analysis of various electrical, electro-mechanical and electronic systems. This subject would cover the behavior of static and dynamic, electric and magnetic fields.

Course Objectives:

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Vector Analysis & Static Electric Fields:** Introduction, scalars and vectors, unit vector, vector addition and subtraction, position and distance vectors, dot product, cross product, scalar triple product, vector triple product, components of a vector, Cartesian co-ordinate system, Circular cylindrical co-ordinate system, Spherical co-ordinate system, transformation from one co-ordinate to other co-ordinate systems. Static	**10**

	Electric Fields Coulomb's law, Electric field intensity, Electric field due to point and line charges, Line surface and volume charge distributions, Gauss' law and its applications, Divergence theorem, Absolute Electric potential, Potential difference, Potential gradient, Calculation of potential difference for different configurations, Electric dipole,	
2	**Conductors, Dielectrics and Capacitance:** Current and current density, Ohm's law in point form, Continuity equation, Conductor-dielectric boundary condition, Dielectric-dielectric boundary condition, Polarization in dielectrics, Capacitance, Capacitance of two wire line	**06**
3	**Poisson's and Laplace's equations:** Poisson's equation, Laplace's equation, Uniqueness theorem, Solution of Poisson's and Laplace's equation, Application of Poisson's and Laplace's equations	**03**
SECTION-B		
4	**Steady Magnetic Fields :** Biot Savart's law, Ampere's law, Curl operation, Stoke's theorem, Magnetic flux and magnetic flux density, Scalar and vector magnetic potentials, Steady magnetic field produced by current carrying conductors	**08**
5	**Magnetic forces, materials and inductance :** Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and Permeability, Magnetic boundary conditions, Magnetic circuit, Inductance and mutual inductances	**08**
6	**Time Varying Fields and Maxwell's equation:** Faraday's Law, Displacement current, Maxwell's equation in point form, Maxwell's equation in integral form,	**03**

Reference Books:

1. W. H. Hayt, J. A. Buck, "Engineering Electromagnetics", McGraw Hill Education
2. M.N.O. Sadiku, S.V. Kulkarni, "Principles of Electromagnetics", 6th edition, Oxford University Press
3. A Pramanik, "Electromagnetism- Theory and Applications" PHI Learning Pvt. Ltd. ,New Delhi, 2009

4. A. Pramanik, "Electromagnetism-Problems with Solutions, PHI, 2012
5. S.P. Seth, "Elements of Electromagnetic fields", Dhanpat Rai & Co, 2013

List of Practical: (Min. 10 Practical should be performed): NA

Course Outcomes:

Students will be able to:

Cos	CO statement
CO.1	Apply vector calculus to electric and potential fields due to various charge distributions
CO.2	Compute potential, Electric fields, Electric flux density, Capacitance using Poisson's and Laplace's equations
CO.3	Derive forces and torques in magnetic fields, forces due to current carrying conductors and their inter-relationship with magnetic field.
CO.4	Analyze Maxwell's equations in different forms (point & integral) and apply them to diverse engineering problems
CO.5	Understanding Magnetic forces, materials and inductance
CO.6	Analyze Time varying Fields fields.

List of Open Source Software/learning website:

- http://www.scilab.org/

- http://www.vlab.co.in/

References used for designing a course:

1. SVNIT
2. GTU
3. PDEU

Bachelor of Engineering
Course Code: EE2208
Course Name: Electrical Power System-I

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Professional Core Course

Prerequisite: Fundamental knowledge of Electrical Engineering

Rationale: The course is aimed to provide exposure about methods of electricity generation, various AC supply systems, transmission lines and their parameters, underground cables and their parameters, substation equipments, neutral grounding and sources of over-voltages and protection against them

Course Objectives:

- To enrich the students with the fair knowledge of Generation systems.
- To understand the various types of transmission and distribution systems.
- To analyze the performance of transmission lines.

Teaching and Examination Scheme:

Teaching Scheme				Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)		
3	0	2	4	70	30	30	20	100

Course Content:

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Power Generation:** Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Generation: Conventional and Renewable Energy Sources (Solar, Wind, Hydro, Thermal & Nuclear)- Schematic Arrangement, Advantages & Disadvantages, Efficiency, Choice of Site, Types of Prime Movers & its Characteristic, Speed Control & Auxiliaries, Environmental Aspects For Selecting Sites & Locations. Indian Electricity Rule-1956: General Introduction. Introduction to open access power.	6
2	**Fundamentals of Power System:**	6

	Basic Principles: Power in single phase AC circuits, Complex power, Complex power balance, Complex power flow, Balanced three phase power. Load curves, Important terms and factors. Load duration curve, Examples. Representation of Power System Components: One line and impedance diagram, Per unit system, Per unit representation of transformer, Per unit impedance diagram of power system, Examples – per unit system and impedance diagram, importance of per unit system, reactance diagram.	
3	**Overhead Transmission Line:** Types of Conductors, Calculation of Line Parameters – Inductance & Capacitance of Single Phase and Three Phase Lines, Symmetrical & Unsymmetrical Configurations, Concepts Of GMD & GMR, Transposition, Bundle Conductors, Double or Parallel Circuit, Calculation of Capacitance for 2 Wire & 3 Wire Systems, Capacitance Calculations for Symmetrical & Asymmetrical Single & Three Phase, Single & Double Circuit Lines, Effect of Earth on Capacitance Calculation, Interference with Communication Circuit, Concept of Corona Discharge.	**6**
SECTION-B		
4	**Performance of Lines:** Short, Medium & Long Lines - Representation, A, B, C, D Constants, Voltage Regulation & Transmission Efficiency, Ferranti Effect, Surge Impedance & Surge Impedance Loading, Charging Current	**6**
5	**Mechanical Features and Design of Overhead Transmission Line:** Main components of overhead lines, Conductor materials, Line supports, Insulators, Types of insulators, String efficiency, Methods of improving string efficiency, Examples, Sag in overhead lines, Calculation of sag, Examples	**6**
6	**Underground Cables:** Different Types, Insulating Materials, Capacitance of Single & 3-Core Belted Cables, Calculations of Insulation Resistance & Stress in Insulation, Dielectric Stress, Grading, Capacitance Grading, Inter-Sheath Grading, Heating & Causes of Breakdown	**6**

Text Books:

1. Modern Power system Analysis: I. J.Nagrath, D. P. Kothari,McGraw Hill Education
2. Power System Analysis: HadiSaadat, McGraw Hill Education India Pvt Ltd.

Reference Books:

1. Principles of Power System: V. K. Mehta, Rohit Mehta, S. Chand Publications

2. Power System Analysis and Design: J. Duncan Glover, Thomas J. Overbye, Mulukutla S. Sarma, Cengage Learning India Pvt. Ltd.
3. Electrical Power systems: C. L .Wadhwa, New Age International Publisher.

List of Practical: (Min. 10 Practical should be performed):

1. Prepare a report about India's and Gujarat's power generation from different sources.
2. Prepare a report after Study and solve the impedance diagram for a given Network
3. Prepare a report after Study and solve the Reactance diagram for a given Network
4. Solve the concepts of GMD and GMR for the inductive conductor.
5. Solve the concepts of GMD and GMR for the Capacitive conductor.
6. Voltage Regulation of a Short Transmission Line.
7. Voltage Regulation of a Medium Transmission Line.
8. Voltage Regulation of a Long Transmission Line.
9. Prepare a report after studying different types of Insulators.
10. Prepare a Consolidated report about various power factor improvement scheme.

Course Outcomes:

Students will be able to:

COs	CO statement
CO.1	Explain the principle of generation of Electric power from different sources
CO.2	Design the model of transmission line, generator and transformer of power system for single line diagram representation and per unit quantity calculation.
CO.3	Understand the effects of line parameters
CO.4	Evaluate performance of short, medium and long transmission lines
CO.5	Understand the factors effecting Overhead and Underground Cable designing.
CO.6	Evaluate the economic analysis of Power system

List of Open Source Software/learning website: MATLAB, NPTEL, VLAB

References used for designing a course:

1. UGC Syllabus Booklet
2. GTU
3. PDPU

Bachelor of Engineering
Course Code: EE2209
Course Name: Electrical Machines-II

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - IV

Type of course: Professional Core Course

Prerequisite: Fundamentals of Basic Electrical Engineering

Rationale: The course will provide strong foundation on A. C. Machines which will be useful for understanding foundation of operation, working, analysis testing and applications of single and three phase motors. The students will learn to proper applications of motors for their efficient use in industry. Students will also explore the industrial applications of such motors.

Course Objective:

- To make students conversant about the underlying energy conversion theory between electrical and mechanical systems by introducing electromechanical energy conversion principles.
- To expose the students to the concepts of various types of electrical AC machines and applications.
- To acquaint the student with the concept of generation of electricity in power plant.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	20	30	150

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Poly-phase Induction Motor:** Construction, Types of motor, Working principle, Rotating magnetic field. Operating parameters at different load, No-load & blocked rotor	10

	test, Equivalent circuit, Phasor diagram, Circle diagram, Efficiency and slip scale with the help of circle diagram, Effect of rotor resistance on performance of motor, Double cage motor and its equivalent circuit, Introduction to machine dynamics. Starters of poly-phase induction motor including soft starter, Methods of speed control of 3- phase motor, Schematic diagram and advantages of Variable Voltage Variable Frequency drive. Electrical transients in induction machine. Effect of harmonics, Harmonic torques, Cogging & Crawling.	
2	**Single phase A. C. motors:** Double field revolving theory, Starting & running performance of 1- phase induction Motor, Equivalent circuit of 1phase induction motor, Types of single phase motors, Principle and operation of split phase, Resistance start, Capacitor start and capacitor start & run induction motor, Shaded pole induction motor.	**6**
3	**Induction Generator:** Principle of operation and application, Its load and p. f. control.	**2**
SECTION-B		
4	**Synchronous Machines:** Construction, Types, Applications, Working principle. Equation of induced EMF with and without harmonics in MMF, pitch factor and distribution factor, MMF of distributed windings, Torque equation, Machine efficiency, Armature reaction and its compensation, Short circuit ratio, Effect of change in excitation, Effect of change in torque and speed, Voltage regulation, Determination of voltage regulation by Synchronous impedance method, MMF method, ZPF method and AIEE method, Synchronization: Importance and Methods of synchronization. Operating characteristic, Load angle and Power flow equations, Capability curves, Two reaction model of Salient pole machines, Parallel operation, Load sharing between parallel connected generators, Effect of unequal voltages & unequal percentage impedance, Introduction to single phase generators, Slip test for measurement of direct axis and quadrature axis reactance for salient pole machine, Sudden short circuit of Synchronous machine, Hunting of synchronous machines and its prevention.	**10**
5	**Synchronous Motor:** Methods of starting of synchronous motors, Different torques in Synchronous motor, Stability, Synchronous condenser, Synchronous phase modifiers, V-curves and O-curves of Synchronous motors, Auto Synchronous Motor: Construction, principle of operation, equivalent excitation current for various rotor connections, circle diagram.	**6**

6	**Commutator motors:** Construction and working principle of Schrage motor, Universal motor and Repulsion motor.	**2**

Text Books:

1. Theraja B L, Electrical Technology – Vol II, S Chand Publications
2. Electrical Machines, P.K. Mukherjee & S. Chakrabarty, DhanpatRai Publication.

Reference Books:

1. Gupta J B, Electrical Machines, S K Kataria Publications
2. Nagrath I J and Kothari D P, Electric Machines, Tata McGraw Hill
3. Bhimbra P S, Electrical Machinery, Khanna Publishers
4. Fitzgerald A.E and Kingsley, Electrical Machinery, Tata McGraw

List of Practical: (Min. 10 Practical should be performed):

1. To study the construction of a three phase induction motor with the help of a cut section model.
2. To perform no load and blocked rotor test on a three phase induction motor to find out its performance parameters with the help of (a) Equivalent circuit (b) Circle diagram
3. To perform direct load test on a three phase induction motor to find out its performance parameters at different load conditions.
4. To study about the starters of three phase induction motors.
5. To perform no load and blocked rotor test on single phase induction motor to obtain its equivalent circuit.
6. To find out voltage regulation of three phase alternator by Synchronous impedance method
7. To find out voltage regulation of three phase alternator by ZPF method
8. To obtain the direct axis and quadrature axis synchronous reactance of a salient pole machine with the slip test.
9. To perform the synchronization of two three phase alternators (or one alternator with grid) using different methods. (a) Lamps dark method (b) Two bright one dark method (c) Synchroscope
10. To obtain the ‘V’curves and Inverted ‘V’ curves to study the effect of power factor in synchronous motor.

Bachelor of Engineering
Course Code: EE2209
Course Name: Electrical Machines-II

Course Outcomes:

Students will be able to:

Sr. No.	CO statement
CO-1	**Explain** the construction, working principle, performance and applications of Poly-phase induction motor, Synchronous Machines.
CO-2	**Predict** correctly the expected performance of single phase motors, synchronous generator (Alternator), synchronous motor and commutator motors.
CO-3	**Compare** accepted standards and guidelines to **select** appropriate electrical machines to meet specified performance requirements.
CO-4	**Perform** experiments on above machines,
CO-5	**Identify**, formulate and solve the numerical problems related to above machines
CO-6	**Access** the techniques, skills, and modern engineering tools necessary for electrical engineering practice. **Choose** the scope of applicability of various types of electrical machines in real life multi-disciplinary usages.

List of Open Source Software/learning website:

Open Source Software:
- LTSpice for circuit simulation,
- KiCAD for CAD application

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

Virtual Lab Website
www.vlab.co.in

References used for designing a course:

1) For Syllabus - Gujarat Technological University
2) For Lab Manual - Gujarat Technological University & Rai University

Bachelor of Engineering
Course Code: EE2210
Course Name: Electrical Estimation, Costing and Wiring

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Professional Elective-1

Prerequisite: Basic knowledge of Electrical components

Rationale: Electrical wiring plays a major role in distributing the electrical energy from electric utilities to consumer. Electrical diploma holders have to work as Technicians and Supervisors for planning, installing and testing various electrical wiring Installations such as residential, commercial and Industrial electrification schemes. They should be able to understanding of the procedure of estimating and costing are desired. Knowledge of IE rules for different types of electrical Installation projects. Essential efforts are made in this course to develop above skills in the students.

Course Objective: To carry out wiring estimating, costing and contract of various types of installations.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Content	Total Hrs.
	SECTION-A	
1	**Electrical Wiring Accessories and symbols:** Type of wires and cables used in Domestic and industrial wiring, Different types of sign and symbols used in wiring, Common Hand Tools their uses, Care and Maintenance, Wiring Accessories and functioning of protective devices such as Fuse, MCB, ELCB, RCCB	5
2	**Electrical Wiring system and IE Rules:** Types of wires, Difference between wire and cable, Standard wire gauge, wiring joints. Specifications of Different types of wiring materials, Accessories. Wiring types and circuits. Domestic and industrial panel wiring. I.E. rules for wiring, IE Act-2003.	5
3	**Selection of Wiring:** System Supply voltage, Selection of wiring, Rules of wiring, power and lighting circuits, Types of Earthing and Measurement of earth resistance.	2
	SECTION-B	
4	**Estimating and Costing of Domestic Wiring:** Layout and single line diagram for	5

	domestic Wiring, Load calculation. Cable/wire selection, calculation of Phase-Neutral-Earthing, Selection of switchgear. Overall Estimating and costing table with all taxes. Related Examples.	
5	**Estimating and Costing of Industrial Wiring:** Layout and single line diagram for Industrial Wiring, Load calculation. Cable/wire selection, calculation of Phase-Neutral-Earthing, Selection of switchgear. Overall Estimating and costing table with all taxes. Related Examples.	**5**
6	**Contracting**: Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills., Types of contract system., Tendering procedure and preparation of simple tender, Earnest Money Deposit, Security Deposit., Schedule of rates (S.O.R.)	**2**

Text Books:

1. Electrical Wiring Estimating And Costing by S. L. Uppal, G. C. Garg, Khanna Publishers, 6th Edition.
2. Electrical Estimating & Costing by Praveen Kumar, 2nd Edition
3. Electrical Estimation and Costing by M. A. Chaudhary and S. M. Chaudhary, Nirali Prakashan.

Reference Books:

1. Electrical Engineering Design, Drawing & Estimation by Madhvi Gupta, Ankit Agarwal, 1st Edition, Publication of S.K. Kataria & Sons
2. Electrical Installation Estimating & Costing by Gupta, J.B., Publication of S.K. Kataria & Sons.
3. Electrical Design, estimating & Costing by Raina, K. B. and Bhattacharya,S.K., New Age International (p) Limited, New Delhi

- **Suggested List of Student Activities (In a Group of 2-3 students)**
  - Prepare a report of Domestic load calculations and make costing table.
  - Prepare a report of Industrial load calculations and make costing table.

Bachelor of Engineering
Course Code: EE2210
Course Name: Electrical Estimation, Costing and Wiring

Course Outcomes:

Students will be able to:

CO	CO statement
CO-1	To memorize the Domestic and industrial wiring following IE Rule Act-2003.
CO-2	To Discuss the estimation and costing of Residential and commercial Electrical Installations following IE Act-2003.
CO-3	To Apply the testing methods of Residential and Industrial Electrical Installation following IE Act-2003.
CO-4	To Prepare the detail estimation and costing of a Residential and Industrial project following IE Act-2003.
CO-5	To Evaluate the Costing of Residential and Industrial wiring including all marginal taxation.
CO-6	To Design the layout of Domestic and Industrial wiring according to load requirement.

List of Open Source Software/learning website:

1) AutoCAD

References used for designing a course:

1) Gujarat Technological University Diploma Curriculum
1) Gujarat Technological University Diploma Curriculum

(Established under Gujarat Private Universities Act, 2009)

Bachelor of Engineering
Course Code: EE2211
Course Name: Renewable Energy Sources

Shroff S.R. Rotary Institute of Chemical Technology

Semester: IV

Type of course: Professional Elective-1
Prerequisite: None
Rationale: The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.
Course Objectives:
The students are expected to identify effective utilization of renewable energy sources for the difference applications & technology.
Teaching and Examination Scheme:

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

Course Content:

Content:

Sr. No,	Contents	Total Hrs
	SECTION A	
1	**Scenario of Renewable Energy (RE) Sources:** Needs of renewable energy, advantages and limitations of RE, present energy scenario of conventional and RE sources in India and worldwide. Comparison between renewable energy and non- renewable energy.	4
2	**Solar Energy:** Solar radiation and related terms, measurement of solar radiation, Instruments for solar radiation measurements. Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle, Different types of Solar cells, Series and parallel connections, Advantages and disadvantages of Solar PV Energy, Applications of Solar PV energy- Solar PV power plant, Solar PV Pond, Solar PV Street light, Conversion of Solar energy into thermal energy, solar energy collectors-flate plate collector, air collector, concentrating collectors, application and advantages of various collectors, Application of solar thermal energy -Solar cookers, Solar hot water systems.	12

Bachelor of Engineering
Course Code: EE2211
Course Name: Renewable Energy Sources

3	**Bio Energy:** Biomass and its conversion technology, biomass gasification, types and applications of gasifiers, Biogas & its types of plant. Advantages and disadvantages of Bio energy, Application of Bio energy.	5
SECTION B		
4	**Wind Energy:** Basic principles, power in wind, force on blades and turbines, wind energy conversion, site selection, basic components of wind energy conservation system (WECS), classification of WECS, wind energy collectors, advantages and disadvantages of wind energy, applications of wind energy, wind pumps.	10
5	**Ocean thermal Energy:** Introduction, Working principle, Resource and site requirements, Location of Ocean thermal energy conversion (OTEC) system, Electricity generation methods from OTEC, open cycle and closed cycle OTEC systems, Advantages and disadvantages, Applications of OTEC	6
6	**Geothermal Energy:** Resources, types of wells, methods of harnessing the energy, Advantages and disadvantages, Application of geothermal energy, potential in India. **Wave Energy:** Introduction, Basics of wave motion, Power in waves, Wave energy conversion devices, Advantages and disadvantages, Applications of wave energy.	5

Text Books:

1. Renewable energy resources: Tiwari and ghosal, Narosa publication.

2. Non-Conventional Energy Sources. G.D.Ray, Khanna Publications.

Reference Books:

1. Non-Conventional Energy Systems: K M. Mittal, A H Wheeler Publishing Co Ltd.

2. Non-conventional energy resources, Shobh Nath Singh, Pearson India

3. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education

4. Biomass Energy, Oxford &IBH Publication Co.

5. Twidell and Wier, Renewable Energy Resources, CRC Press (Taylor and Francis).

6. C.S. Solanki, Renewal Energy Technologies: A Practical Guide for Beginners PHI Learning.

Bachelor of Engineering
Course Code: EE2211
Course Name: Renewable Energy Sources

Course Outcomes:

COs	CO statement
CO-1	To Understand the Need, importance and scope of non-conventional and alternate energy resources
CO-2	To understand role significance of solar energy in the energy generation.
CO-3	To get the utilization of Biogas plants and biomass energy
CO-4	To provide importance of Wind Energy.
CO-5	To learn the importance of ocean energy
CO-6	To understand the role of Geo thermal energy & Wave energy in the Energy Generation

Students will be able to:

List of Open Source Software/learning website:

http://nptel.ac.in/courses/112104117/18
http://nptel.ac.in/courses/112104117/4
http://nptel.ac.in/courses/112104117/17