



Evaluation Reforms NEP 2020
2nd Year Bachelor of Engineering
Electrical Engineering

Shroff S R Rotary Institute of Chemical Technology,
Ankleshwar

EFFECTIVE FROM A.Y. 2026-27

**Teaching Scheme For
Second Year BE Electrical Engineering**

(Semester-III)

Sub Code	Subject	Teaching Scheme (hrs. / week)			Total Hr.	Credit C	Examination Scheme				
		L	T	P			SEE	CCE	I/TW	V	Total
BUNBS311	Maths-III	3	1	0	4	4	50	50	25	25	150
BEEPC301	Electrical Machines-I	3	0	2	5	4	50	50	25	25	150
BEEPC302	Circuit and Network	3	0	2	5	4	50	50	25	25	150
BEEPC303	Electrical Measurements & Measuring Instruments	3	0	2	5	4	50	50	25	25	150
BUNAE321	English Proficiency Course	2	0	2	4	3	50	50	25	25	150
BUNVA331	Yoga for Well Being	0	0	4	4	2	0	0	25	25	50
	Total	14	1	12	27	21	250	250	150	150	800

(Semester-VI)

Sub Code	Subject	Teaching Scheme (hrs./week)			Total Hr.	Credit C	Examination Scheme				
		L	T	P			SEE	CCE	I/TW	V	Total
BEEPC401	Electrical Machines – II	3	0	2	5	4	50	50	25	25	150
BEEPC402	Signals and Systems	3	0	2	5	4	50	50	25	25	150
BEEPC403	Analog and Digital Electronics	3	0	2	5	4	50	50	25	25	150
BEEVS404	Electrical and Electronics Workshop	0	0	2	2	1	0	0	25	25	50
BEEPE405/ BEEPE406	Utilization of Electrical Energy and Traction/ Electric Materials	3	0	0	3	3	50	50	0	0	100
BUNVA431	Universal Human Values	2	0	0	2	2	50	50	0	0	100
BXXOE441	Open Elective Course-I	2	0	0	2	2	50	50	0	0	100
	Total	16	0	8	24	20	300	300	100	100	800
Multi-Disciplinary Minor Course											
BXXMD451	Multi-Disciplinary Minor Course - 1	3	0	2	5	4	50	50	25	25	150

L Lecture
T Tutorial
P Practical
C Credit

SEE - Semester End Examination
CCE - Continuous and Comprehensive Examination
I - Internal
TW - Term Work
V - Viva

Open Elective - I (Semester – IV)

(Open Electives for Electrical Engineering Students)

Sr.	Course Code	Course	Offered by
1	BMEOE441	Basics of Maintenance Engineering	Department of Mechanical Engineering
2	BEVOE441	Industrial Wastewater Treatment	Department of Environmental Science & Technology
3	BCHOE441	Introduction to Chemical Industry	Department of Chemical Engineering
4	BITOE441	IT for Sustainability	Department of Information Technology
5	BCTOE441	Materials Engineering	Department of Chemical Technology
6	BCOOE441	Emerging Technologies	Department of Computer Engineering
7	BITOE441	IT for Sustainability	Department of Information Technology

**Detailed syllabus separately available*

MDC - I (Semester – IV)

Multidisciplinary Minor Course (MDC-I) for Electrical Engineering Students

Sr.	Course code	MDC-I (Semester-4)	Minors	Offered by (Branch)
1	BMEMD451	Boiler and Steam Utility Systems	Mechanical Aspects of Process	Department of Mechanical Engineering
2	BEVMD451	Introduction to Environmental Management	Environmental Management	Department of Environmental Science & Technology
3	BCHMD451	Process Safety and Risk Management	Industrial Safety	Department of Chemical Engineering
4	BITMD451	Fundamentals of Cloud and Virtualization	Cloud computing	Department of Information Technology
5	BCOMD451	Fundamentals of Data Science	Data Science	Department of Computer Engineering
7	BPRMD451	Fundamentals of Pharmaceutical Engineering	Pharmaceutical Engineering	Department of Pharmaceutical Technology
8	BGCMD451	Fundamentals of Materials Science and Engineering	Ceramics Engineering	Department of Glass & Ceramics Technology
9	BDPMD451	Introduction to Paint and Coating Technology	Paint Technology	Department of Dyes & Pigments Technology
9	BPRMD451	Chemistry of Polymers	Polymer Science and Engineering	Department of Polymer & Rubber Technology

**Detailed syllabus separately available*

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B.E. Semester III

Mathematics –III (BUNBS311)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	1	0	4	4	50	50	25	25	150

COURSE OVERVIEW: This course introduces second-year B.E. students to advanced mathematical techniques such as Laplace Transforms, Fourier series and Integrals, Double Integrals, and Complex Variables. It focuses on developing analytical and problem-solving skills for engineering applications. The course enables students to apply mathematical tools effectively in solving real-world engineering problems.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (45)
SECTION-A			
1	Fourier Series: Periodic function, Trigonometric series, Fourier series, Functions of any period, Even and odd functions, Half-range Expansion.	1	7
2	Fourier integral: Sine and cosine integral, even and odd functions	2	6
3	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, Evaluation of integrals using Laplace transformation.	4	10
SECTION-B			
4	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.	5	10
5	Double integral and its applications : over rectangular and general regions, properties of double integrals, Change of order, change of variables, Area by double Integrals.	6	7
6	Curve Sketching: Curve sketching in Cartesian Co-ordinates and Polar co-ordinates, Relation between Polar and Cartesian Co-ordinates.	3	5

LIST OF TUTORIALS

1. Tutorial-1 (Fourier Series)
2. Tutorial-2 (Fourier Series)
3. Tutorial-3 (Fourier Integral)
4. Tutorial-4 (Laplace Transform)
5. Tutorial-5 (Laplace Transform)
6. Tutorial-6 (Inverse Laplace Transformation)
7. Tutorial-7 (Inverse Laplace Transformation)
8. Tutorial-8 (Double Integral and its application)
9. Tutorial-9 (Double Integral and its application)
10. Tutorial-10 (Curve sketching)

TEXT BOOKS:

1. Advanced Engineering Mathematics 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).

ONLINE RESOURCES:

- <https://digimat.in/nptel/courses/video/111105134/L36.html>
- <http://www.digimat.in/nptel/courses/video/122104017/L12.html>
- <https://www.digimat.in/nptel/courses/video/111105123/111105123.html>

COURSE OUTCOMES

CO1	Define Laplace and Inverse Laplace transformation, Fourier Series and Integral.
CO2	Solve differential equations Using Laplace transform and inverse Laplace Transformation.
CO3	Sketch the Cartesian and Polar graphs.
CO4	Calculate the area using Double integrals.
CO5	Construct a Fourier integral to evaluate the Integral.
CO6	Evaluate the sum of series using Fourier series.

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B.E. Semester III

Electrical Machines-1 (BEEPC301)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

This subject provides foundational knowledge of DC Machines and transformers, essential components in electrical power systems and industrial applications. It equips students with analytical and practical skills for evaluating machine performance, efficiency, and control methods. By integrating theoretical concepts with hands-on analysis, the subject prepares students for real-world challenges in power engineering.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (45)
SECTION-A			
1	Principles of Electromechanical Energy Conversions 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.	1	7
2	DC Machines Construction and operating principle, types of dc machines, the concept of DC generators, emf equation of generator, armature reaction, back emf, construction and operating principle of DC Motor, starters, torque equation, operating characteristics, speed control, construction and working of Permanent Magnet DC motor, characteristics and applications of Permanent Magnet DC motor.	2, 3	9
3	Testing of DC Machines Brake Test, Swinburne's Test, Regenerative/Hopkinson's Test, Retardation/Running Down Test and Field's Test for DC Motors.	3	6
SECTION-B			
4	Single-Phase Transformers Construction and operating principle of single-phase transformer, operation at no load and on load, phasor diagram, equivalent circuit, various losses, efficiency, voltage regulation and its calculation for different power factor, all-day efficiency, the concept of power and distribution transformer, auto-transformer and its applications.	4, 5	7
5	Three-Phase Transformers Construction and operating principle of a three-phase transformer, different types of connections, phasor diagrams, open delta connection, Scott connection, selection of three-phase transformers for various applications.	4, 5	9
6	Testing of Transformers direct testing and indirect testing of transformer and Sumpner's Test along with connection diagrams, efficiency and regulation of transformer,	6	7

Derivation of equivalent circuit and its related parameters, Need of parallel operation, essential and desirable conditions for parallel operation, load sharing between transformers in parallel.		
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LIST OF PRACTICAL

1. To obtain Magnetizing Characteristic of Self Excited DC Shunt Generator.
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 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.
7. Identify polarity of transformer winding by "Polarity test of transformer".
8. To evaluate the performance of a 1- \emptyset transformer (efficiency and regulation) by indirect load test i.e. using S.C & O.C test.
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. Speed control of DC Shunt Motor using a) Armature control and b) field control methods.

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.

ONLINE RESOURCES:

List of Open-Source Software/learning website:

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

COURSE OUTCOMES

CO1	Describe the basic energy conversation principle in electrical machines.
CO2	Infer the construction and operating principles of transformers and DC machines.
CO3	Demonstrate the connection diagram and conduct performance experiments on DC machine and Transformer.
CO4	Illustrate the operating principle, range and efficiency for Transformer.
CO5	Identify the selection criteria for transformers for various applications.
CO6	Optimize the performance of transformer by various tests and parallel operations.

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B.E. Semester III

Circuit and Network (BEEPC302)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

Electrical Circuit Analysis equips students with essential skills to analyse and solve complex electrical circuits and networks. The syllabus encompasses key topics such as network theorems, transient and steady state responses, sinusoidal analysis, Laplace transforms, and two-port networks. These concepts enable students to understand, model, and optimize circuit performance, fostering problem-solving and analytical abilities. This course lays the groundwork for advanced studies and practical applications in electrical engineering, preparing students for challenges in power systems, electronics, and control systems.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs. (45)
SECTION-A			
1	Circuit Fundamentals Mesh and Nodal Analysis - Super-mesh and Super-Node Analysis with independent and dependent sources, Duality.	1	7
2	Network Theorems Superposition, Thevenin's, Norton's, Maximum power transfer, Millman's and Reciprocity theorem in DC and AC circuits.	2	9
3	Initial and Final Conditions Initial and final conditions in Resistive, Inductive and Capacitive networks, procedure for evaluating initial conditions, transient analysis of DC & AC circuits, Concept of steady state and transient state response, Analysis of standard signals.	3	7
SECTION-B			
4	Time Domain Analysis Steady state response and forced response of series RL circuit, Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, forced and free response, time constants, steady state and transient state response. Transient response of RLC circuit with sinusoidal excitation.	4	9
5	Laplace Analysis Laplace transform of standard signals, Shifting theorem, initial and final value theorem, solution of circuit equations by Laplace transform, evaluation of circuit response for various signals.	5	7
6	Network Function and Two Port Networks Introduction to Two Port Networks, relationship of two port variables, Short circuit admittance parameter, Open-circuit impedance parameter, Transmission Parameter, Hybrid Parameter, Relationships between parameters.	6	6

LIST OF PRACTICAL / TUTORIALS

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 measure and calculate RC time constant for a given RC circuit.
9. To measure and calculate RC time constant for a given RL circuit.
10. To measure and calculate Z-parameters for a given two-port system.
11. To measure and calculate Y-parameters for a given two-port system.

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

ONLINE RESOURCES:

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

COURSE OUTCOMES

CO1	Identify the use of circuit law's and methods for circuit analysis.
CO2	Apply network theorems for the analysis of electrical circuits.
CO3	Understand the initial and final behavior of system in time domain.
CO4	Explain the transient and steady state operation of electrical circuits.
CO5	Reframe the circuit analysis with Laplace Transform.
CO6	Write the behavior of two-port circuit.

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B.E. Semester III

Electrical Measurements and Measuring Instruments (BEEPC303)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW:

This course provides a fundamental understanding of the principles, construction, and operation of various electrical and electronic measuring instruments. Students explore the techniques for measuring parameters like resistance, inductance, capacitance, power, and energy while analysing measurement errors. It also introduces modern digital instrumentation and transducers, essential for industrial automation and power system monitoring.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (48)
SECTION-A			
1	Measurement Concepts & Errors: Concepts: Significance of measurement, static and dynamic characteristics (accuracy, precision, sensitivity, resolution). Error Analysis: Classification of errors, statistical analysis, limiting errors, and uncertainty. Standards: Introduction to absolute and secondary instruments, Indian and International standards.	1	08
2	Electromechanical Indicating Instruments: Operating Forces: Deflecting, controlling, and damping torques. Types: Construction and working of PMMC, Moving Iron, Electro-dynamometer, and Induction type instruments. Range Extension: Design of shunts and multipliers for ammeters and voltmeters.	2	08
3	Digital Measurement & Transducers: Digital Voltmeters (DVM): Successive Approximation and Dual Slope Integration (for noise rejection). Oscilloscopes: Triggering circuits, Z-modulation, and the use of 10x Probes. Transducers: Active vs. Passive; LVDT (Linear Variable Differential Transformer) sensitivity and null voltage; Strain Gauges and the concept of Gauge Factor.	3	06
SECTION-B			
4	Bridges & Potentiometers: Resistance: Measurement of low (Kelvin Double Bridge), medium (Wheatstone Bridge), and high resistance (Megger/Loss of Charge). AC Bridges: Maxwell's, Hay's, Anderson's (Inductance); Schering and	4	08

	De-Sauty's (Capacitance). Potentiometers: Principle of DC Crompton's and AC (Polar/Coordinate) potentiometers; applications in calibration.		
5	Instrument Transformers & Magnetic Testing: Current Transformers (CT): Phasor diagram, derivation of Ratio Error and Phase Angle Error. Effects of secondary open circuit. Potential Transformers (PT): Constructional differences from power transformers; error reduction techniques. Magnetics: Lloyd-Fisher Square for core loss measurement; determination of iron loss using Wattmeter method.	5	08
6	Measurement of Power and Energy: Power: Electrodynamometer wattmeter, errors and compensations, measurement of active and reactive power in 3-phase systems. Energy: Single-phase and three-phase induction type energy meters, driving and braking torques, testing, and calibration.	6	07

LIST OF PRACTICAL / TUTORIALS

1. Measurements of resistance and find out errors in measurements.
2. Measurement of Low Resistance using Kelvin's Double Bridge.
3. Measurement of Medium Resistance using Wheatstone Bridge.
4. Measurement of Self-Inductance using Maxwell's Inductance Bridge.
5. Measurement of Capacitance and loss angle using Schering Bridge.
6. Measurement of Power in a 3-phase circuit using the Two-Wattmeter Method.
7. Measurement of Phase and Frequency using Lissajous patterns on a CRO.
8. Measure the voltage and current with the help of current transformer and potential transformers.
9. Study static and dynamic characteristics of the temperature sensors (Thermocouple and RTD).
10. Study of Displacement Measurement using LVDT.

TEXT BOOKS:

1. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation";
2. R.K. Rajput, "Electrical Measurements and Measuring Instruments".

REFERENCE BOOKS:

1. E.W. Golding & F.C. Widdis, "Electrical Measurements and Measuring Instruments";
2. J.B. Gupta, "A Course in Electronic and Electrical Measurements".

ONLINE RESOURCES:

- NPTEL Course, "Electrical Measurement and Electronic Instruments" by Prof. Avishek Chatterjee, Department of Electrical Engineering, IIT Kharagpur, <https://nptel.ac.in/courses/108105153>
- Virtual Labs, IIT Bombay
- https://iitb.vlabs.co.in/discipline.html?discipline=Electrical_Engineering

COURSE OUTCOMES

CO1	Identify and analyse the types of errors in measurement systems and their impact on accuracy.
CO2	Demonstrate the working principle and construction of analog instruments for DC and AC measurements.
CO3	Interface Transducers with Digital Storage Oscilloscopes to capture and analyse transient electrical signals.
CO4	Formulate bridge balance equations to determine unknown impedance components (L, C and R) at varying frequencies.
CO5	Analyse the performance of Instrument Transformers and their role in high-voltage measurements.
CO6	Evaluate power and energy consumption in electrical circuits using standardized metering techniques.

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B.E. Semester III

English Proficiency Course (BUNAE321)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
2	0	2	4	3	50	50	25	25	150

COURSE OVERVIEW: 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.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (30)
SECTION-A			
1	Dynamics of Communication: Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations	1	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	2	4
3	Technical Communication: Public speaking, Group discussion, Presentation strategies, Interview skills, Negotiation skills ,Critical and Creative thinking in communication	3	5
SECTION-B			
4	Ethics in Engineering: Scope of engineering ethics, Accepting and sharing responsibility , Resolving ethical dilemmas, Making moral choices	4	4
5	Etiquettes: Telephone etiquettes, Etiquettes for foreign business trips, Etiquettes for small talks, Respecting privacy, Learning to say NO, Time management.	5	5
6	Self-development and Assessment: Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream	6	6

LIST OF PRACTICALS AND TERM WORK (9 to 10 Experiments/TW)

1. Role Play
2. Letter Writing
3. Group Discussion
4. Presentation
5. Book Review (Preferably related to self- development)
6. Mock Interview
7. Report Writing
8. Case studies related to unit 4, 5 and 6
9. Conducting meeting with Agenda
10. Minutes of the Meeting

TEXT BOOKS:

1. Raman and Sharma, Technical Communications, OUP, New Delhi, 2017

REFERENCE BOOKS:

1. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018
2. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014
3. Mohapatra and Sreejesh S., Case Studies in Business Ethics and Corporate Governance, Pearson, UP, 2013
4. Ramesh and Ramesh, The Ace of Soft Skills, Pearson, UP, 2019
5. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009

ONLINE RESOURCES:

- <https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases>

COURSE OUTCOMES

CO1	Define and describe dynamics of verbal and non-verbal aspects of communication.
CO2	Associate with various formal documents of technical and professional communication
CO3	Interpret communication of diverse formal situations taking place in organizations.
CO4	Illustrate and examine the knowledge of ethical aspects of engineering
CO5	Establish and explain social and professional etiquettes.
CO6	Recommend self -development and self - assessment.

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B.E. Semester III

Yoga for Well-Being (BUNVA331)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
0	0	4	4	2	00	00	25	25	50

COURSE OVERVIEW: This course introduces yoga, asana, and pranayama for improving physical and mental well-being. It covers techniques to prevent lifestyle diseases, enhance body balance, and develop mindfulness. The module also focuses on meditation practices and stress management through yoga, promoting a healthy, balanced, and disciplined lifestyle for overall personal development.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (60)
1	Yoga and Asana <ul style="list-style-type: none"> • Meaning, Definition and Importance of Yoga • Meaning, Definition and Importance of Asana • Asanas for Prevention of Lifestyle Diseases 	1	20
2	Pranayama and Body Balance <ul style="list-style-type: none"> • Meaning, Definition and Importance of Pranayama • Various Types of Pranayama • Importance of Pranayama for Balanced Body and Mind 	2	20
3	Yoga Meditation and Stress Management <ul style="list-style-type: none"> • Meaning, Definition and Importance of Yoga Meditation • Basic Meditation Techniques • Stress Management through Yoga 	3	20

List of Practical

1. Performance and viva of minimum 1-**topic** including explanation of benefits.
2. **Demonstration of skills, techniques, and basic rules** of any 5 selected Asana),
3. Any one of the Topic as specialization.
4. Asana Practical.

TEXT BOOKS

1. Yoga Education – NCERT (National Council of Educational Research and Training)
2. Common Yoga Protocol – Ministry of AYUSH, Government of India
3. Yoga for Healthy Living – Swami Ramdev / Baba Ramdev’s Yoga Textbook

REFERENCE BOOKS

1. The Heart of Yoga – T.K.V. Desikachar
2. Yoga for Wellness – Yoga Journal Books
3. Light on Yoga – B.K.S. Iyengar
4. Yoga: Its Meaning, Theory and Practice – Swami Digambarji

ONLINE RESOURCES

1. <https://www.ayush.gov.in/>
2. <https://svyasa.edu.in/>
3. <https://www.artofliving.org/>
4. <https://nimhans.ac.in/>

COURSE OUTCOMES

CO1	Understand the fundamentals of Yoga, Asanas, Pranayama, and Meditation for holistic health and mental well-being.
CO2	Develop practical skills to perform Asanas and Pranayama with correct posture and breathing.
CO3	Apply yogic practices for improving fitness, managing stress, and preventing lifestyle-related diseases.
CO4	Build self-discipline through log-book and project work, and track personal health and fitness progress.

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B.E. Semester IV

Electrical Machines-II (BEEPC401)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW: The Electrical Machines II course provides in-depth knowledge of AC machines, synchronous machines, and special machines, essential for understanding their construction, operation, and performance characteristics. It equips students with analytical and practical skills for machine selection, performance evaluation, and industrial applications. The subject also integrates modern motor technologies like BLDC, PMSM, and SRM, preparing students for advancements in electric drives and automation.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (45)
	SECTION-A		
1	Polyphase Induction Machines Construction, rotating magnetic field, principle of operation, torque and power equations, torque/slip characteristics, performance calculations, vector diagram, equivalent circuit, circle diagram, starting methods, speed control – conventional and v/f control, crawling and cogging, modelling of induction motor, applications of induction motor, operating principle and applications of induction generator.	1, 2, 5	10
2	Single-phase AC Motors Types, double field revolving theory, equivalent circuit, determination of motor parameters, Starting & running performance of 1- phase induction Motor, methods of starting and applications.	1, 2, 5	6
3	Synchronous machines Constructional Details, Working Principle, Types of rotor (cylindrical and salient pole), Rotating Magnetic Field, EMF equation, Armature winding (Effect of distribution factor, pitch factor). Armature Reaction, its effects and remedies.	3, 5	6
	SECTION-B		
4	Synchronous Generator (Alternator) Principle of operation, constructional features and types, emf equation, distribution and coil span factors, armature reaction in cylindrical and salient pole machines, two reaction theory, equivalent circuit of cylindrical and salient pole machines, voltage equation, output equations, vector diagrams, voltage regulation by synchronous impedance, MMF and Zero Power Factor (ZPF) method, Short Circuit Ratio (SCR), concept of reactive power control through excitation system, synchronizing conditions and methods, operational aspects of alternators on infinite bus.	3, 4	9
5	Synchronous Motor	4, 5	6

	Operating principle, voltage equation, phasor diagram, torque and power equations, steady state operating characteristic, 'V' and inverted 'V' curves, starting, hunting, damper windings and its effect, synchronous condenser, working principle of auto synchronous motor.		
6	Special machines Permanent Magnet DC Motor (PMDC): Construction, working, and applications. Brushless DC Motor (BLDC): Construction, working principle, control techniques, and applications. Stepper Motor: working principle, and applications. Servo Motor: AC & DC servo motors, working, and industrial applications.	6	8

LIST OF PRACTICAL / TUTORIALS

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.

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

ONLINE RESOURCES:

Learning website –

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

COURSE OUTCOMES

CO1	Illustrate constructional features and operating principle of induction machine and synchronous machine.
CO2	Analyze characteristics of induction machine and synchronous machine for different operating conditions.
CO3	Analyze the performance characteristics, armature reaction, voltage regulation, and power output of synchronous machines under different operating conditions.
CO4	Compare accepted standards and guidelines to select appropriate electrical machines to meet specified performance requirements.
CO5	Evaluate the efficiency, speed control methods, and suitability of different electrical machines for industrial applications.
CO6	Compare the construction, control methods and applications of special electrical machines such as PMDC, BLDC, Stepper and Servo motors.

UPL University of Sustainable Technology
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B.E. Semester IV

Signals and Systems (BEEPE402)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW: The Signals and Systems course introduce the fundamental concepts of continuous-time and discrete-time signals, their representation, classification and properties. It focuses on the analysis of linear time invariant systems using mathematical tools such as convolution, Fourier transform, Laplace transform and Z-transform. The course also highlights practical applications including sampling, signal reconstruction, filtering and basic IoT-based signal acquisition and processing.

COURSE CONTENT:

Sr. No.	Topics	COs	Hrs (45)
SECTION-A			
1	Introduction to Signals and Systems: Signals and systems everyday life, biomedical, instrumentation domestic and industries. Representations of Signals, Classifications of Signals – Continuous time, Discrete time, comparison among Analog, Digital and Discrete Signals, Signal properties: periodicity, absolute integrability, determinism and stochastic character. System properties: linearity: additivity and homogeneity, shift in variance, causality, stability, realizability. Examples	1	08
2	Mathematical operations on Signals and Systems: Addition, subtraction, multiplication and division of the signals, parallel and series combinations of the systems, cascading of the systems, impulse response characterization and convolution integral for CT- LTI system, signal responses to CT-LTI system, properties of convolution, LTI system response properties from impulse response, Examples. Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system. DT-LTI system properties from Impulse response, System analysis from difference equation model, examples.	2	08
3	Z-Transform: The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	3	06
SECTION-B			
4	Fourier, Laplace Transform: Representation of periodic functions, Fourier series, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform and its properties. Parseval's Theorem.	4	08

	Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior.		
5	Sampling & Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	5	08
6	Applications based on IoT: Introduction of the Internet of Things, Types of sensors, Types of actuators, Introduction of Arduino Interfacing of the sensors and actuators with Arduino. Programming in Arduino. Signals storage and its analysis using Arduino.	6	07

LIST OF PRACTICAL / TUTORIALS

1. To generate and visualize basic continuous-time and discrete-time signals using MATLAB.
2. To perform mathematical operations such as addition, subtraction, multiplication and division on signals using MATLAB.
3. To analyze the properties and classification of signals including periodic, aperiodic, energy and power signals using MATLAB.
4. To determine the output of continuous-time LTI systems using convolution operation in MATLAB.
5. To compute the convolution sum for discrete-time signals and analyze DT-LTI system response using MATLAB.
6. To study impulse response and step response of linear time invariant systems using MATLAB.
7. To compute Fourier series coefficients and reconstruct periodic signals using MATLAB.
8. To analyze the frequency spectrum of signals using Fourier Transform in MATLAB.
9. To analyze continuous-time systems using Laplace Transform and pole-zero representation in MATLAB.
10. To compute Z-Transform and plot pole-zero diagrams of discrete-time systems using MATLAB.
11. To verify the sampling theorem and observe aliasing effects using MATLAB.
12. To design and analyze simple digital filters for signal processing using MATLAB.
13. To acquire, store and analyze real-time signals using Arduino interfaced with MATLAB.

TEXT BOOKS:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
2. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
3. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
4. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education

REFERENCE BOOKS:

1. Signal and Systems by Anand Kumar, 3rd Edition, PHI
2. Internet of Things: Technologies, Applications, Challenges and Solutions by B. K. Tripathy & J. Anuradha, CRC Press, 2017.

ONLINE RESOURCES:

1. NPTEL Course “Signals and System” offered by Prof. Kushal K. Shah, Department of Electrical and Electronics Engineering, IISER, Bhopal and Prof. Hitesh Shrimali, Department of Electrical and Electronics Engineering, IIT, Mandi.
2. Virtual Labs, IIT Guwahati
[https://www.iitg.ac.in/cseweb/vlab/Signal-System-Lab/signalsystem/Signals%20and%20their%20properties\(simulator\).html](https://www.iitg.ac.in/cseweb/vlab/Signal-System-Lab/signalsystem/Signals%20and%20their%20properties(simulator).html)

COURSE OUTCOMES

CO1	Describe the type of system and signal in Industries and Domestic level for Interfacing.
CO2	Derive mathematical model of the systems and signals for the applications.
CO3	Analyze the response of system for the efficient usage of the systems.
CO4	Derive mathematical model of the systems and Laplace & Fourier applications.
CO5	Understanding Sampling Theorem and its application.
CO6	Design of the system from the available input signals and expected output signals of the industrial model.

UPL University of Sustainable Technology
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B.E. Semester IV

Analog and Digital Electronics (BEEPC403)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	2	5	4	50	50	25	25	150

COURSE OVERVIEW: This course introduces the fundamentals of operational amplifiers and digital electronics, covering Op-Amp characteristics, configurations, and applications such as amplifiers, filters, and oscillators. It also includes number systems, logic gates, Boolean algebra, and the design of combinational and sequential circuits like adders, flip-flops, and counters. Overall, the course develops the ability to analyze and design basic analog and digital electronic systems.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs. (45)
SECTION-A			
1	Fundamentals and Characteristics of Op-Amp: Concept of differential amplifier, Ideal Op-Amp characteristics, Practical Op-Amp characteristics, Open-loop vs closed-loop operation, Virtual ground and virtual short concept, Input offset voltage, bias current, and offset current, CMRR (Common Mode Rejection Ratio), PSRR (Power Supply Rejection Ratio), Slew rate and bandwidth, Frequency response of Op-Amp.	1,2,5	8
2	Basic Op-Amp Configurations and Analysis: Inverting amplifier (gain derivation and applications), Non-inverting amplifier (gain derivation and applications), Differential amplifier.	3,5	6
3	Operational Amplifiers & Applications: Ideal and practical Op-Amp characteristics, Op-Amp configurations (Inverting, Non-inverting, Voltage follower), Applications: Integrator, Differentiator, Summing amplifier, Active filters (LPF, HPF), Oscillators (RC, Wien bridge) and Introduction to IC 555 timer.	4,5,6	8
SECTION-B			
4	Number Systems & Logic Gates: Binary, Octal, Decimal, Hexadecimal number systems, Code systems (BCD, Gray code), Logic gates and truth tables, Boolean algebra and simplification, Karnaugh Map (K-map) minimization.	1,2,4	7
5	Combinational Logic Circuits: Half and Full Adders/Subtractor, Multiplexers and Demultiplexers, Encoders and Decoders, Comparators, Code converters, Implementation using logic gates.	3,4,6	8
6	Sequential Logic Circuits: Latches and Flip-Flops (SR, JK, D, T), Registers and Shift registers, Counters (Asynchronous and Synchronous), Finite State Machines (basic concept), Introduction to ADC and DAC, Memory devices basics.	4,5,6	8

LIST OF PRACTICAL / TUTORIALS

- 1) To study the effect of positive and negative feedback on amplifier gain and bandwidth.
- 2) To design and test RC phase shift oscillator and measure its frequency.
- 3) To design and test LC oscillator / Crystal oscillator circuit.
- 4) To study IC 555 timer in Astable and Monostable mode and measure output waveform.
- 5) To study characteristics of Op-Amp (IC-741) and measure input offset voltage.
- 6) To design and test inverting and non-inverting amplifier using Op-Amp.
- 7) To implement Op-Amp as integrator and differentiator.
- 8) To implement Op-Amp applications: adder, Subtractor, voltage follower and comparator.
- 9) To generate sine, triangular and square waves using Op-Amp / 555 timer.
- 10) To perform number system conversions and binary arithmetic operations.
- 11) To verify De Morgan's theorems and implement basic logic gates using ICs.
- 12) To simplify Boolean expressions using Karnaugh Map (up to 4 variables).
- 13) To design and verify combinational circuits (Half Adder, Full Adder, Multiplexer, De-multiplexer).
- 14) To study and verify R-S, JK and D flip-flops.
- 15) To design and test counters and shift registers.
- 16) To study the operation of DAC and ADC circuits.

TEXT BOOKS:

1. Op-Amps and Linear Integrated Circuits by Ramakanth A. Gayakwad, Pearson publication (Indian Edition widely used)
2. Linear Integrated Circuits by D. Roy Choudhury & Shail B. Jain, New Age International publications.
3. Electronic Devices and Circuit Theory by Robert L. Boylestad & Louis Nashelsky (Indian Adapted Edition), Pearson India publications.
4. Digital Electronics by R. P. Jain, at McGraw-Hill (India) Publications.
5. Fundamentals of Digital Circuits by A. Anand Kumar, Prentice-Hall of India / PHI Learning (Indian edition) Publications.

REFERENCE BOOKS:

1. Operational Amplifiers and Linear ICs by K. Lal Kishore, Pearson India Publications.
2. Analog Electronics by S. Salivahanan, N. Suresh Kumar & A. Vallavaraj, McGraw-Hill India Publications.
3. Modern Digital Electronics by R. P. Jain, McGraw-Hill India Publications.
4. Digital Design by M. Morris Mano & Michael D. Ciletti, 6th Edition Pearson Education (India) Publication.

ONLINE RESOURCES:

1. NPTEL – Analog Circuits
2. MIT Open Course Ware
3. www.malvino.com
4. Tinkercad Software (Free online)
5. M. Morris Mano based lectures (Digital Design concept videos on YouTube)
6. SWAYAM Courses (Free + Certificate Option)
 - Digital Electronics (Dr. P. Sivasankar)

- Digital Logic and Circuits Simulations (BHU)
- Basic Electronics (NIT Puducherry)
- Integrated Circuits and Applications (IIT Guwahati + SWAYAM)
- Basic Electronics – Coursera (BITS Pilani)

COURSE OUTCOMES

CO1	Define and describe the fundamental concepts of operational amplifiers, number systems, logic gates, and basic electronic components.
CO2	Explain the characteristics and parameters of Op-Amps (CMRR, PSRR, slew rate, bandwidth), and interpret Boolean algebra and logic simplification techniques.
CO3	Apply circuit analysis techniques to determine gain and output response of inverting, non-inverting, and differential amplifiers, and implement basic combinational logic circuits.
CO4	Analyze Op-Amp based circuits (integrator, differentiator, filters, oscillators) and evaluate combinational and sequential logic circuits using K-maps and truth tables.
CO5	Evaluate the performance of analog and digital circuits considering practical limitations such as offset parameters, frequency response, propagation delay, and noise margins.
CO6	Design and develop basic analog and digital electronic systems using Op-Amps, logic gates, flip-flops, counters, and ADC/DAC interfaces to meet specified engineering requirements.

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B.E. Semester IV

Electrical & Electronics Workshop (BEEVS404)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
0	0	2	2	1	0	0	25	25	50

COURSE OVERVIEW: This course covers electrical workshop practices including wiring, electronic component testing, and soldering techniques. It introduces Arduino Uno architecture, embedded system interfacing, communication, and IoT basics. Students learn PCB design and circuit simulation using Altium Designer and Proteus. The course also includes Electrical CAD using AutoCAD Electrical and EPLAN, Mechanical CAD basics with SolidWorks, and small panel design, culminating in a mini project integrating practical and design skills.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs. (30)
SECTION-A			
1	Electrical Workshop Practice: <ul style="list-style-type: none"> Various Wires Joint and wiring exercises with testing Testing of Electronic Components like Diode, SCRs, IGBT, MOSFET, ICs etc. Soldering and desoldering 	1,6	4
2	Arduino Uno and Embedded System Applications: Architecture, Installation, Basic Interfacing Experiments, Communication & IoT Basics.	2,6	6
3	PCB Design & Simulation Software: Altium Designer – Professional PCB design (industry standard) Proteus – Schematic, PCB & circuit simulation	3,6	6
SECTION-B			
4	Electrical CAD & Installation Drawing Software: <ul style="list-style-type: none"> AutoCAD Electrical software practice EPLAN Electric P8 software practice 	4,6	4
5	Mechanical CAD & Installation Drawing Software: <ul style="list-style-type: none"> Basics of Solid works software & modelling Designing of Small Panel 	5,6	4
6	Mini Project	1,2,3,4,5,6	6

LIST OF PRACTICAL / TUTORIALS

1. Perform various wire joints (Straight, Tee, Britannia) and test continuity
2. Testing of SCR, MOSFET, and IGBT using simple test circuits
3. PCB soldering and desoldering practice (component mounting on general-purpose PCB)

4. Arduino Uno setup and IDE installation with LED blinking
5. Analog input interfacing using potentiometer / temperature sensor
6. Basic IoT application (sensor data transmission via Wi-Fi module)
7. Design and simulate an electronic circuit using Proteus/PSim/MatLab
8. Design PCB layout from schematic using Proteus / Altium Designer
9. Prepare electrical schematic and panel/enclosure model using AutoCAD Electrical / EPLAN / SolidWorks
10. PWM control using Arduino (LED dimming / motor speed control)
11. Electrical schematic drawing using AutoCAD Electrical / EPLAN
12. 3D modelling and small panel/enclosure design using SolidWorks
13. Minor Project

TEXT BOOKS:

- “Electrical Workshop Practice” – H.S. Bawa
- “Practical Electronics for Inventors” – Paul Scherz
- “Getting Started with Arduino” – Massimo Banzi
- “Complete PCB Design Using OrCAD Capture and PCB Editor” – Kraig Mitzner
- Engineering Drawing with AutoCAD” – K. Venugopal
- “Mastering SolidWorks” – Ibrahim Zeid

REFERENCE BOOKS: NA

ONLINE RESOURCES:

1. Coursera : Arduino, IoT, PCB basics courses
2. YouTube channels: DroneBot Workshop
3. Proteus Video Tutorials Collection
4. Arduino Simulation in Proteus Guide
5. AutoCAD Electrical Tutorial Series

COURSE OUTCOMES

CO1	Apply wiring techniques, perform wire joints, test electronic components, and demonstrate proper soldering and desoldering practices.
CO2	Analyze Arduino Uno architecture and implement basic embedded interfacing and IoT communication experiments.
CO3	Design and simulate electronic circuits and PCB layouts using Proteus and Altium Designer software.
CO4	Develop electrical installation drawings and panel schematics using AutoCAD Electrical and EPLAN software.
CO5	Model and design basic mechanical components and small electrical panels using SolidWorks software.
CO6	Create and integrate a mini project combining hardware assembly, embedded programming, PCB design, and CAD documentation.

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B.E. Semester IV

Utilization of Electrical Energy and Traction (BEEPE405)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
2	0	0	2	2	50	50	0	0	100

COURSE OVERVIEW: The course Utilization of Electrical Energy and Traction deals with the practical applications of electrical energy in various domestic, commercial, and industrial fields. It focuses on the efficient use of electrical power in areas such as electric heating, welding, lighting systems, and electrochemical processes. The subject helps students understand how electrical energy is converted into useful forms for different applications.

The course also introduces the principles of electric traction, which includes the use of electrical energy for transportation systems such as electric trains, trams, and metro systems. Students learn about traction motors, power supply systems, braking methods, and the performance characteristics of electric traction.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (30)
SECTION-A			
1	Introduction to Utilization of Electrical Energy: Importance and advantages of electrical energy utilization, Classification of electrical energy applications, Energy efficiency and conservation in electrical energy utilization	1	2
2	Types of electric heating: Resistance heating- direct and indirect resistance heating, Induction heating, Dielectric heating, Applications and advantages of electric heating in industry, Properties of resistance heating elements, Electric arc heating- Working and applications of arc furnace, Infra-red heating and its applications, Electric Cooling: Thermoelectric Cooling (Peltier Effect)	2	5
3	Electric Drives: Advantages of electric drives, Characteristics of different mechanical loads, Four quadrant operation of motor, Types of motors used in electric drive, Electric braking, Plugging, Rheostat braking, Regenerative braking, Methods of power transfer by direct coupling by using devices like belt drive, gears, pulley drives etc., Examples of selection of motors for different types of domestic loads	3	8
SECTION-B			
4	Electric Traction: Requirements of ideal traction system, Traction mechanics, Types of services, Speed time curve, Supply system: DC system, Composite system, Single phase ac system with low and normal frequency, Three phase system	4	7

5	Electric Welding: Welding methods, Principles of resistance welding, types – spot, projection seam and butt, welding and welding equipment used, Advantages of electric welding, comparison between AC and DC arc welding	5	4
6	Electrolytic Processes: Need of electro-deposition, Laws of electrolysis, process of electro deposition, Equipment and accessories for electroplating, Factors affecting electro deposition, Electroplating on non-conducting materials	6	4

LIST OF PRACTICAL / TUTORIALS (Suggest at least 15 practicals)

NA

TEXT BOOKS: (Suggest at least 5 books)

1. Generation and Utilization of Electrical Energy by S. Sivanagaraju, Pearson
2. Art and Science of Utilization of Electrical Energy by H.Partap, Dhanpat Rai & Sons
3. Utilization of Electrical Energy by J. B. Gupta, Kataria Publications
4. A Text Book of Electrical Power by Dr. S. L. Uppal, Khanna Publications
5. Modern Electric Traction by H.Partap, Dhanpat Rai & Sons

REFERENCE BOOKS: (Suggest at least 5 books)

1. Utilisation of Electric Energy – by E. Openshaw Taylor
2. Utilization of Electrical Power Including Electric Drives and Electric Traction – by N. V. Suryanarayana
3. Utilisation of Electric Power – by R. K. Rajput
4. Generation, Distribution and Utilization of Electrical Energy – by C. L. Wadhwa

ONLINE RESOURCES:

- www.nptel.ac.in
- www.learnengg.com

COURSE OUTCOMES

CO1	Explain the concept of electric drives and the factors affecting the selection of motors for different industrial applications.
CO2	Describe different methods of electric heating such as resistance heating, induction heating, and dielectric heating.
CO3	Explain the concept and advantages of electric drives, characteristics of different mechanical loads, and four-quadrant operation of motors.
CO4	Analyze the performance of traction systems and identify suitable supply systems for railway electrification.
CO5	Explain the basic welding methods and principles of resistance welding.
CO6	Explain the need for electro-deposition and state the laws of electrolysis.

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B.E. Semester IV

Electric Materials (BEEPE406)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
3	0	0	3	3	50	50	0	0	100

COURSE OVERVIEW: This course introduces the fundamental concepts of electrical engineering materials and their applications. It covers classification, atomic structure, and properties of electrical materials, along with dielectric and insulating materials used in capacitors and insulation systems. Students learn about magnetic materials and their applications in electrical machines, semiconductor physics and devices, and the basic principles and applications of superconductors.

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (45)
SECTION-A			
1	Introduction to Electrical Materials Importance and classification of electrical materials, Atomic structure and bonding in materials, Energy band theory of solids conductors, semiconductors, and insulators, Properties of electrical materials: electrical, mechanical, thermal, and chemical properties	1	7
2	Dielectric Materials Polarization in dielectric materials, Dielectric constant and dielectric loss Dielectric strength and dielectric breakdown Ferroelectric, piezoelectric, and pyroelectric materials, Applications of dielectric materials in capacitors and insulation systems	2	7
3	Insulating Materials Properties of insulating materials, Classification of insulating materials, Solid insulating materials (paper, mica, rubber, plastics, ceramics), Liquid insulating materials (transformer oil), Gaseous insulating materials (air, SF ₆), Breakdown mechanisms and insulation failure	3	7
SECTION-B			
4	Magnetic Materials Magnetic properties of materials, Diamagnetic, paramagnetic, and ferromagnetic materials, Hysteresis loop and magnetic losses, Soft magnetic and hard magnetic materials, Applications in transformers, motors, and magnetic devices	4	8
5	Semi-Conductors General concepts, Energy bands, Types of semiconductors: intrinsic Semiconductors, extrinsic Semi-conductors, compound semiconductor, amorphous semiconductor, Hall effect, drift, mobility, Diffusion in Semiconductors, semi-conductors and their applications.	5	8
6	Superconductors	6	8

Superconductivity, Superconducting materials, Properties of superconductors, BCS Theory, critical field, Meissner effect, type-I and type-II Superconductors, Applications of superconductors		
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TEXT BOOKS: (Suggest at least 5 books)

1. Electrical Engineering Materials – R. K. Rajput, Laxmi Publications.
2. Electrical Engineering Materials – K. M. Gupta, Umesh Publications.
3. Electrical Engineering Materials – C. S. Indulkar & S. Thiruvengadam, S. Chand & Company Ltd.
4. Electrical Engineering Materials – T. K. Basak, S. Chand & Company Ltd.

REFERENCE BOOKS: (Suggest at least 5 books)

1. Electrical Engineering Materials – A. J. Dekker, Prentice-Hall of India.
2. Electrical Engineering Materials – S. P. Seth, Dhanpat Rai & Sons.
3. Electrical Engineering Materials – R. K. Shukla, Tata McGraw-Hill Education.
4. Electrical Engineering Materials – A. K. Sawhney, Dhanpat Rai Publications.
5. Electrical Engineering Materials – S. L. Uppal, Khanna Publishers.

ONLINE RESOURCES:

www.nptel.ac.in
www.learnengg.com

COURSE OUTCOMES

CO1	Explain the importance, classification, and basic properties of electrical materials used in electrical engineering applications.
CO2	Identify different dielectric materials such as ferroelectric, piezoelectric, and pyroelectric materials and explain their applications in capacitors and insulation systems.
CO3	Explain the properties and classification of insulating materials used in electrical equipment.
CO4	Explain the magnetic properties of materials and their classification.
CO5	Explain the basic concepts of semiconductors and energy band theory.
CO6	Explain the concept of superconductivity and properties of superconducting materials.

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B.E. Semester IV

Universal Human Values (BUNVA431)

Teaching Scheme (Hrs./week)				Credit	Examination Scheme				
L	T	P	Total		SEE	CCE	I/TW	V	Total
2	0	0	2	2	50	50	0	0	100

COURSE OVERVIEW: This course introduces second-year B.E. Course helps the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings

COURSE CONTENT

Sr. No.	Topics	COs	Hrs (30)
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.	1	6
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.	2	4
3	Harmony in the Human Being : Understanding Human being as the Coexistence 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, Program to ensure self-regulation and Health	3	5
SECTION-B			
4	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.	4	4
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.	5	5
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	6	6

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.

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)

ONLINE RESOURCES:

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

COURSE OUTCOMES

CO1	Relate themselves with the surroundings (family, society, nature)
CO2	Explain sustainable solutions with respect to problems, keeping in mind the correlation between human relationships and human nature.
CO3	Apply what they have learnt, into various day to day schedule.
CO4	Distinguish between ethical and unethical practices and start working out the strategy in order to materialize a harmonious environment in the work place.
CO5	Justify their commitment with respect to their understanding regarding human values, relationship and society.
CO6	Develop the understanding of the intricacy of the problem and design appropriate solution