HINDI SEVA MANDAL'S (ESTD. 1950)
SHRI SANT GADGE BABA
COLLEGE OF ENGINEERING & TECHNOLOGY
BHUSAWAL - 425 203, DIST. JALGAON(M.S.)
NBA Accredited Courses, AICTE New Delhi
'A+' Accredited by NAAC, Government of India
Approved by AICTE, New Delhi ; Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere
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Ref. No. SSGBCOET/2025-2026/ Date :04 / 05 /2026

Notification

It is hereby notified that the syllabus of Second year Electrical Engineering (UG) as recommended by the Board of Studies in the meeting dated 18.04.2026 and duly approved by the Academic Council in its meeting held on 25.04.2026 is to be implemented from current academic session, i.e., 2026-2027.

The approved syllabus shall be implemented from the Academic Year 2026-27 for all concerned semesters of the Second year Electrical Engineering (UG).

All Head of Departments, faculty, and students are hereby informed to take note of the same and implement the syllabus accordingly.

Dr. A.P.Chaudhari
Head & BoS Chairperson
Electrical Engineering

Prof. Dr. G. A. Kulkarni
Member Secretary,
Academic Council

Prof. Dr. R. B. Barjibhe
Principal
Chairman, Academic Council

S.S.G.B.College of Engg. & Tech. Bhusawal 425 203

Hindi Seva Mandal's,
Shri Sant Gadge Baba
College of Engineering & Technology,
Near Z.T.C., Bhusawal. Dist.- Jalgaon (Maharashtra) Pin-425203.

An Autonomous Institute
Accreditation by NAAC with A+ Grade

(Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere.)

www.ssgbcoet.com

Bachelor of Technology
(B. Tech) In
Electrical Engineering
Programme Curriculum

With Effect from the Academic Year 2026-2027

4-year, 8 Semester Full time Programme Choice-Based Credit System (CBCS) and Grading System Outcome Based Education Pattern Aligned with National Education Policy (NEP) 2020

Program Specific Outcomes (PSOs)

PSO1: SPECIFY, DESIGN and EVALUATE electrical circuits, machines, power systems and control systems using modern simulation, modelling and analysis software.

PSO2: APPLY knowledge of electrical machines, power electronics, renewable energy systems, instrumentation, automation and modern engineering tools for analysis, operation and maintenance of electrical systems.

PSO3: APPLY core aspects of power generation, transmission, distribution, protection and energy management to determine the performance, efficiency and reliability of electrical power systems including conventional and renewable energy sources.

Program Educational Objectives (PEOs)

PEO1: The graduate will have a successful career in electrical engineering with strong technical competence, analytical ability, research aptitude and professional ethics.

PEO2: The graduate will possess the ability to work effectively in multidisciplinary and diversified fields related to electrical engineering with teamwork, communication skills and leadership qualities.

PEO3: The graduate will engage in lifelong learning, higher education, research, innovation and adapt to the rapidly evolving technological environment of electrical and allied industries.

Programme Outcomes (POs)

Program Outcomes (POs) are statements that articulate what students are expected to know, understand, and be able to do by the time they graduate from the program. These outcomes are aligned with the overall educational objectives of the program and reflect the skills, knowledge, attitudes, and behaviors acquired by students throughout their academic journey. On successful completion, students will be able to:

POs No.	Title	Program Outcome Description
P01	Engineering knowledge	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.
P02	Problem analysis	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
P03	Design / Development of Solutions	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
P04	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
P05	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
P06	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment
P07	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
P08	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
P09	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
P10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
P11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) Independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Abbreviations

PEO	**:**	Program Educational objectives
PO	**:**	Program Outcomes
CO	**:**	Course Outcomes
L	**:**	No. of Lecture hours (per week)
T	**:**	No. of Tutorial hours (per week)
P	**:**	No. of Practical hours (per week)
C	**:**	Total number of credits
CA	**:**	Continuous Assessment
MSE	**:**	Mid Semester Examination
ESE	**:**	End Semester Examination
PCC	**:**	Professional Core Course
OE	**:**	Open Elective
PEC	**:**	Programme Elective Course
IKS	**:**	Indian Knowledge Society
MDM	**:**	Multidisciplinary Minor
HSSM	**:**	Humanities Social and Management
VEC	**:**	Value Education course
CEP	**:**	Community Engineering Project
VSEC	**:**	Vocational and skill Enhancement course
EN	**:**	Entrepreneurship
AEC	**:**	Ability Enhancement Course

Shri Sant Gadge Baba College of Engineering and Technology, Bhusawal.
Department of Electrical Engineering
Proposed Second Year Structure 26-27 as per NEP 2020

SEMESTER III												
Course Category	**Category under NEP**	**Course Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				
				L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	**No. of Credits**
PCC	Programme Core Course	BTEE25PC301	Applied Mathematics for Electrical Engineering	3	0	0	20	20	60	100	3
PCC	Programme Core Course	BTEE25PC302	Electrical Machine – I	3	0	0	20	20	60	100	3
PCC	Programme Core Course	BTEE25PC303	Electrical Measurements	2	0	0	20	20	60	100	2
MDM	Multidisciplinary Minor Bucket	BTEE25MD304	**MDM-1**	3	0	0	20	20	60	100	3
OE	Open Elective Bucket	BTEE25OE305	**Open Elective-I**	3	0	0	20	20	60	100	3
PCC	Programme Core Course Lab	BTEE25PC306L	Electrical Measurements Lab	0	0	2	50		50	100	1
PCC	Programme Core Course Lab	BTEE25PC307L	Electrical Machine – I Lab	0	0	2	50		50	100	1
OE	Open Elective Lab	BTEE25OE308L	**Open Elective-I Lab**	0	0	2	50		50	100	1
HSSM	Entrepreneurship	BTEE25HM309	Case Study/EDP Programme/ Start Up Activity	0	0	4	50			50	2
VEC	Value Education Course	BTEE25VEC310	Basics of Human Rights	1	0	0	50			50	1
VEC	Value Education Course	BTEE25VEC311	Indian Constitution- Value Education	1	0	0	50			50	1
CEP	Community Engineering Project	BTEE25CEP312	Field Visit/Special Study/ Internship/ Social Activity Project/ Community Initiative			4	50		0	50	2
	Total			**16**	**0**	**14**	**450**	**100**	**450**	**1000**	**23**

MDM offers to other department: Instrumentation Engineering

MDM** (The students will have to choose the MDM course being offered by other disciplines available/ offered at the college)

Open Elective-I	
A	Engineering Materials Science
B	Electronic Devices and Circuits
C	Solid State Devices & Circuits
D	Illumination Engineering

Shri Sant Gadge Baba College of Engineering and Technology, Bhusawal
Department of Electrical Engineering
Proposed Second Year Structure 26-27 as per NEP 2020

SEMESTER IV											
Course Category	**Category under NEP**	**Course Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				
				L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	**No. of Credits**
PCC	Programme Core Course	BTEE25PC401	Electrical Machine – II	3	0	0	20	20	60	100	3
PCC	Programme Core Course	BTEE25PC402	Network Theory	3	0	0	20	20	60	100	3
PCC	Programme Core Course	BTEE25PC403	Power System – I	2	0	0	20	20	60	100	2
MDM	Multidisciplinary Minor Bucket	BTEE25MD404	**MDM–2**	3	0	0	20	20	60	100	3
OD	Open Elective Bucket	BTEE25OE405	**Open Elective II**	2	0	0	20	20	60	100	2
AEC	Programme Core Course Lab. (AEC)	BTEE25AE406L	Network Theory Lab	0	0	2	50		50	100	1
AEC	Programme Core Course Lab (AEC)	BTEE25AE407L	Electrical Machine – II Lab	0	0	2	50		50	100	1
VSEC	Open Elective Course Lab (VSEC)	BTEE25VSE408L	**Open Elective II Lab**	0	0	2	50		50	100	1
VSEC	Vocational & Skill Enhancement Course	BTEE25VSE409	Workshop/Skill Activity/Course/Seminar	0	0	2	50			50	1
HSSM	Humanities Social Science and Management	BTEE25HM410	Universal Human Values – II	3	0	0	20	20	60	100	3
EN	Entrepreneurship	BTEE25HM411	Mini Project/ Case Study/EDP Programme/ Start Up Activity	0	0	4	50	0	0	50	2
VEC	Value Education Course	BTEE25VEC412	Life of Shri Sant Gadge Baba	1	0	0	0		0	0	AU
VEC	Value Education Course	BTEE25VEC413	Moral and Ethical Development	1	0	0	50			50	1
	Total			**18**	**00**	**12**	**420**	**120**	**510**	**1050**	**23**

MDM offers to other department: Renewable Energy Sources
MDM** (The students will have to choose the MDM course being offered by other disciplines available/ offered at the college)

Open Elective-II	
A	Analog and Digital Electronics
B	Signals and System
C	Embedded System
D	Electromagnetic Engineering

MULTIDISCIPLINARY COURSES OF ELECTRICAL ENGINEERING OFFERED TO OTHER DEPARTMENTS									
Category	**Course Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				**No. of Credits**
			L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	
MDM	BTEE25MD304	Instrumentation Engineering	3	0	0	20	20	60	100	3
MDM	BTEE25MD404	Renewable Energy Sources	3	0	0	20	20	60	100	3
MDM	BTEE25MD505	Solar Energy	3	0	0	20	20	60	100	3
MDM	BTEE25MD510L	Solar Energy Lab.	0	0	2	50	0	50	100	1
MDM	BTEE25MD606 A	Electric Vehicle	2	0	0	20	20	60	100	2
MDM	BTEE25MD606 B	Numerical Methods and Simulation Techniques	2	0	0	20	20	60	100	2
MDM	BTEE25MD705	Battery & Charging Station Management System	2	0	0	20	20	60	100	2

SUBJECT CODE BTEE25PC301	SUBJECT Applied Mathematics for Electrical Engineering	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 03 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1.	To master the analytical methods for solving n^{th} order Linear Differential Equations (LDE) with constant and variable coefficients.
2.	To understand the properties of Laplace Transforms and their application in evaluating improper integrals.
3.	To solve complex linear differential equations using Laplace and Inverse Laplace Transform techniques.
4.	To apply Fourier Integral Theorem and its transforms to solve engineering problems in the frequency domain.
5.	To explore Complex Variables, analyticity, and contour integration for solving steady-state engineering problems.

Course Outcomes:- At the end of the course, the student will be able to

CO1	Solve higher-order LDEs using complementary functions, particular integrals, and the method of variation of parameters.
CO2	Evaluate improper integrals and special functions (Heaviside, Dirac Delta) using Laplace Transform properties.
CO3	Formulate solutions for initial value problems and differential equations using the Convolution Theorem.
CO4	Apply Fourier Sine, Cosine, and Complex transforms to simplify and solve integral equations.
CO5	Analyze the analyticity of complex functions and evaluate line integrals using Cauchy's Residue Theorem.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	1	1	–	–	–	–	–	2
CO2	3	2	2	1	1	–	–	–	–	–	2
CO3	3	3	2	2	2	–	–	–	–	–	2
CO4	3	3	2	2	1	–	–	–	–	–	2
CO5	3	2	2	2	1	–	–	–	–	–	2

Course Contents:

Unit I: Linear Differential Equation **[08 Hours]**

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters (second order only); Cauchy's homogeneous and Legendre's linear equations.

Unit II: Laplace Transform **[08 Hours]**

Definition – conditions for existence; Transforms of elementary functions; Properties of Laplace transforms - Linearity property; first shifting property; second shifting property; transforms of functions multiplied by t^n; change of scale property; transforms of functions divided by t; transforms of integral of

functions; transforms of derivatives; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Unit III: Inverse Laplace Transform **[08 Hours]**

Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations.

Unit IV: Fourier Transform **[08 Hours]**

Definitions – integral transforms; Fourier integral theorem (without proof); Fourier sine and cosine integrals ; Complex form of Fourier integrals; Fourier sine and cosine transforms; Properties of Fourier transforms.

Unit V: Complex Analysis **[08 Hours]**

Function of Complex Variables; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books/ Reference Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & Co. Pvt. Ltd., New Delhi.
6. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
7. A Text Book of Engineering Mathematics by Peter O‟ Neil, Thomson Asia Pvt Ltd., Singapore.
8. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw- Hill Publishing Company Ltd., New Delhi

SUBJECT CODE BTEE25PC302	SUBJECT Electrical Machine – I	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 Hr./Week Tutorial :– Practical:–	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	Understand the fundamental principles, construction, and operation of single-phase and three-phase transformers.
2	Analyze the performance of transformers through equivalent circuits, phasor diagrams, and efficiency calculations.
3	Explore the constructional details and working principles of DC Generators, including the effects of armature reaction.
4	Evaluate the operational characteristics, speed control methods, and starting mechanisms of various DC Motors.
5	Apply testing methods (like Swinburne's and Hopkinson's) to determine the efficiency and losses of DC machines.

Course Outcomes:- At the end of the course, the student will be able to

CO1	Analyze the performance of single-phase transformers by developing equivalent circuits and calculating regulation and efficiency.
CO2	Distinguish between various three-phase transformer connections (Star, Delta, Scott, Open-Delta) and their specific industrial applications.
CO3	Explain the process of EMF generation in DC generators and propose remedies for armature reaction and voltage build-up failure.
CO4	Determine the torque and speed characteristics of DC motors and select appropriate speed control methods for specific engineering tasks.
CO5	Conduct and interpret standardized tests on DC machines to evaluate performance parameters and maximum efficiency conditions.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	2	1	1	1	–	–	–	2
CO2	3	2	3	2	1	2	1	1	1	1	2
CO3	3	3	2	3	1	1	–	1	1	1	1
C04	3	3	3	2	2	2	2	1	1	1	2
C05	3	2	2	3	2	2	2	2	2	3	2

UNIT – I: Single Phase Transformers **[08 Hours]**

Construction, Operating principle, E.M.F. equation, Transformer on no load & different loads, Pharos diagrams, Voltage regulation, Losses, Efficiency, Condition for maximum efficiency, Equivalent circuit refer to either sides, Autotransformers, Voltage& current transformers, Welding transformers.

UNIT – II: Three Phase Transformers **[08 Hours]**

Construction, Working principle, Connections, Factors affecting the choice of connection, Voltage pharos diagram, Vector groups, Open delta or V–V connection, Scott's connection, Applications of various transformers, parallel operation of transformer.

UNIT – III: D. C. Generator **[08 Hours]**

Construction of D. C. machine, Basic principles of working, E.M.F. Equation, Types, Characteristics and applications of different types of D. C. generators, Building up of E.M.F. in D.C. shunt generator, Causes of failures to voltage built up and remedies. Armature reaction in D.C. machines, Demagnetizing and cross magnetizing m.m.f.s and their estimation, remedies to overcome armature reaction.

UNIT – IV: D. C. Motor **[08 Hours]**

Basic principles of working, Significance of back E.M.F., Torque equation, Types, Characteristics and applications of different types of D.C. motors, Reversing and speed control by armature voltage and field control and starters.

UNIT – V: Starting and Testing of D. C. Machine **[08 Hours]**

Types of starters for D. C. motors, Losses and efficiency, Condition for maximum efficiency, Break test, Swinburne test, Hopkinson's test.

Text Books/ Reference Books:

1. P. C. Sen., "Principles of Electric Machines and Power Electronics", John Wiley and Sons Inc.
2. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata Mc-Graw Hill Publication.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers.
4. B. L. Theraja, "Electrical Technology", Vol. – II, S. Chand Publications.
5. B. R. Gupta, "Fundamental of Electric Machines", New Age International Publication.
6. S. K. Bhattacharya, "Electrical Machines", Tata McGraw hill, Delhi.
7. Bhag S. Guru, Husayin R. Hizirggly, "Electric Machinery & Transformers", Oxford University press, New York.

SUBJECT CODE BTEE25PC303	SUBJECT Electrical Measurements	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: 02 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	Illustrate the fundamental concepts of measurement and the operational mechanics of analog meters (PMMC/MI).
2	Analyze power and energy measurement techniques in both single and three-phase systems.
3	Evaluate unknown electrical parameters using various DC and AC bridge configurations.
4	Examine the role of instrument transformers and the conversion of physical quantities into electrical signals via transducers.
5	Develop an understanding of modern digital measurement tools, including CROs and Smart Grid metering technologies.

Course Outcomes:- At the end of the course, the student will be able to

CO1	Differentiate between different types of analog instruments and calculate parameters for range extension.
CO2	Solve complex problems related to power and energy measurement in industrial circuits.
CO3	Design and balance bridge circuits to accurately measure resistance, inductance, and capacitance.
CO4	Select appropriate transducers for specific engineering applications based on their sensitivity and range.
CO5	Operate electronic testing equipment like DSO and explain the architecture of smart metering systems.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	1	1	–	–	–	–	1
CO2	3	3	2	2	2	2	2	1	1	1	2
CO3	3	3	3	3	2	1	1	1	1	2	2
CO4	3	3	2	3	3	2	2	2	2	1	3
CO5	3	2	3	2	3	3	3	2	2	3	3

UNIT - I: Introduction **[06 Hours]**

Definitions – Accuracy, tolerance, sensitivity, reproducibility, absolute and secondary measuring instruments, recording instruments.

Analog Ammeters and Voltmeters:

Permanent magnet Moving Coil (PMMC) & Moving Iron (MI) instruments: construction, torque equation range extension, effect of temperature, classification, errors, advantages and disadvantages.

UNIT - II: Analog Wattmeter and Power Factor Meters **[06 Hours]**

Electrodynamometer type: wattmeter & power factor meter: construction, working, torque equation, advantages and disadvantages; Measurement of active and reactive power in single phase and in three phase with balanced loads.

Analog Energy Meter: Single phase induction type energy meters, construction, working, lag adjustments, errors; Maximum demand indicators.

UNIT - III: Electrical Bridges **[06 Hours]**

DC bridges: Wheatstone, Kelvin's, Kelvin's double bridge, Megger, Earth resistance measurement.

AC bridges: Maxwell's bridges, Anderson, Schering, Wien for measurement of inductance and capacitance and their limitations.

UNIT - IV: Instrument Transformers **[06 Hours]**

Construction, working, ratio error and phase errors, testing & applications of current transformer and potential transformer.

Transducers: Thermistor, RTD, thermocouple, LVDT, strain gauge, piezoelectric transducers, digital shaftencoders, tachometer, Hall Effect sensors.

UNIT - V: Electronic Instruments **[06 Hours]**

Digital voltmeters, Dual trace and dual beam Cathode Ray Oscilloscopes (CRO), measurement of voltage and frequency, Digital voltmeters, Dual trace and dual beam Cathode Ray Oscilloscopes (CRO), measurement of voltage and frequency, Digital Storage Oscilloscope.

Smart Energy Meter: Digital energy meter design components; circuit diagram; Digital meter software algorithm; meter working principle; Automatic Meter Reading (AMR).

Text Books/ Reference Books:

1. Electrical Measurements and Measuring Instruments, E.W. Golding, F.C. Widdis, Reem Publications, 2011.
2. Electronic Instrumentation and Measurements, H S Kalsi, McGraw Hill, Fourth Edition, 2019
3. Introduction to Measurements and Instrumentation, Arun K. Ghosh, Fourth Edition, Eastern Economy Edition, PHI Learning, 2012.
4. Dr. Shashikant Bakre, Electricity Metering in Easy Steps : Anoutline book on smart energy meters for everyone, 2015.
5. Sawhney A. K., Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 2015.

SUBJECT CODE BTEE25MD304	SUBJECT Instrumentation Engineering	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	An introduction to measurement techniques and instrumentation design and operation
2	The basic concept of units, measurement error and accuracy, the construction and design of measuring devices and circuits, measuring instruments and their proper applications.
3	To learn the working of different types of Signal generators.
4	To learn the basics of oscilloscope and it types.
5	To use different measuring techniques and the measurement of different physical parameters using different transducers.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Explain the working principles and applications of basic measuring instruments like DC voltmeters, DC ammeters, AC voltmeters, AC ammeters, ohmmeters, and multimeters.
CO2	Understand the basic principles and applications of wave analyzers used for analyzing electrical waveforms.
CO3	Understand the working principle of Cathode Ray Tubes (CRTs) and evaluate high-frequency considerations and the use of delay lines in improving CRO performance.
CO4	Understand and apply fundamental concepts of measurement systems, sensors, and transducers for industrial and scientific applications.
CO5	Understand and apply bridge circuits such as Wheatstone, Kelvin, and Maxwell bridges for accurate measurement of electrical parameters like resistance, inductance, and low resistance.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	2	1	1	–	–	–	–	1
CO2	3	3	2	3	2	1	1	–	–	1	2
CO3	3	2	2	3	3	1	1	1	1	1	2
C04	3	3	3	2	2	2	2	1	1	1	3
C05	3	3	3	3	3	2	3	2	2	3	3

UNIT - I: Block Schematics of Measuring Systems [08 Hours]

Introduction, Advantages of Electronic Measurement, Classification of Measuring Instruments, Functional elements of an instrument, Performance characteristics, Static characteristics, Accuracy, Precision, Resolution, Types of Errors, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag; Measuring Instruments: DC Voltmeters, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters.

UNIT - II: Signal Analysers [08 Hours]

Introduction, Basic Wave analyzer, AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary waveform Generator.

UNIT - III: Oscilloscopes [08 Hours]

Introduction, CRT, Block Schematic of CRO, Time Base Circuits, CRO Probes, High Frequency CRO Considerations, Delay lines. Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs.

UNIT - IV: Transducers **[08 Hours]**

Classification, Strain Gauges, Bounded, unbounded; Force and Displacement Transducers, Resistance Thermometers, Hotwire Anemometers, LVDT, Thermocouples, Synchros, Special Resistance Thermometers, Piezoelectric Transducers, Magneto Strictive Transducers.

UNIT - V: Bridges **[08 Hours]**

Wheat Stone Bridge, Kelvin Bridge, and Maxwell Bridge. Measurement of Physical Parameters: Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Pressure - High Pressure, Vacuum level, Temperature - Measurements, Data Acquisition Systems.

Text Books/ Reference Books:

1. Electronic instrumentation: H. S. Kalsi - TMH, 2nd Edition 2004.
2. Modern Electronic Instrumentation and Measurement Techniques: A.D. Helbincs, W.D. Cooper: PHI, 5th Edition, 2003.
3. Electronic Instrumentation and Measurements - David A. Bell, Oxford Uiv. Press, 1997.
4. Electronic Measurements and Instrumentation: B. M. Oliver, J. M. Cage TMH Reprint.
5. Measurement Systems - Emest O. Doebelin and Dhanesh N Manik, 6th Ed., TMH.
6. Electronic Measurements and Instrumentations by K. Lal Kishore, Pearson Education - 2010.
7. Industrial Instrumentation: T. R. Padmanabham Spiriger 2009.

SUBJECT CODE BTEE25OE305A	SUBJECT Engineering Materials Science	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To provide a fundamental understanding of the atomic structure and bonding that governs the electrical, magnetic, and optical properties of materials.
2	To analyze the behavior of dielectric and semiconductor materials, focusing on polarization, charge carrier dynamics, and VLSI applications.
3	To explore the characteristics of magnetic materials, including domain theory and hysteresis, for application in electrical machines.
4	To introduce the concepts of superconductivity and modern applications like cryotrons and thermocouples.
5	To familiarize students with testing methodologies (NDT) and the selection of special-purpose materials for industrial environments.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Explain the conduction mechanisms in metals and superconductors using parameters like relaxation time, mean free path, and temperature effects.
CO2	Analyze dielectric properties and polarization mechanisms to select appropriate insulating materials for high-voltage equipment and capacitors.
CO3	Evaluate semiconductor characteristics, including carrier concentration and mobility, and understand their role in VLSI and alloy-based applications.
CO4	Classify magnetic materials based on their domain structure and hysteresis loops to design efficient magnetic circuits for electrical machines.
CO5	Apply Non-Destructive Testing (NDT) techniques and Bragg's Law to inspect materials and identify suitable refractory or radioactive materials for specialized engineering tasks.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	2	1	1	–	–	–	–	1
CO2	3	3	3	2	2	2	2	1	1	1	2
CO3	3	2	2	2	3	1	1	–	–	1	2
CO4	3	3	3	2	1	2	1	1	1	1	2
CO5	3	2	2	3	3	3	3	2	2	3	3

UNIT – I: Electrical Conducting Materials [08 Hours]

Introduction, Crystal structure, atomic bonding, Electronic and Ionic Conduction, Conductivity in Metals, Ohm‘s Law, Relaxation Time, Collision Time, Mean Free Path of an Electron, Resistivity of Metals , Effect of Temperature and Impurity on Conductivity, Joule‘s Law , High Conductivity And Resistivity Materials, Superconductivity, cryotons and other modern application of super conductivity, thermocouple materials.

UNIT – II: Dielectric Materials [08 Hours]

Crystalline structure-perfection/imperfection, Dielectric as Electric Field Medium, Dielectric constant and polarizability, types of polarization, dielectric loss, dielectric strength, breakdown voltage, temperature and frequency dependences of Dielectric parameter, Clausius-Mosotti equation, ferroelectric, Different type of insulating material used for electric machines, transformer, power cable, capacitors and electronic equipment. Testing of insulating material as per I.S. specification.

UNIT – III: Semiconductor Materials **[08 Hours]**

Semiconductors: Mechanism of conduction in semiconductors, Properties of semiconductors, Large and very large scale integration techniques (VLSI). Properties of Semiconductors: Electron-hole concentration, Fermi level, Generation and recombination, carrier life- time, diffusion length. Scattering and mobility of carriers, Alloy steels: High speed steels, stainless steels, HSLA; Non Ferrous alloys: Al alloys, Cu alloys, applications of these alloys.

UNIT – IV: Magnetic Materials **[08 Hours]**

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, Magnetostriction, diamagnetism, magnetically soft and hard materials, factors effecting permeability and hysteresis, Curie point, Electric sheet steel, Hot rolled and Cold rolled steel, Magnetic Properties of Materials: Atomic Interpretation of Diamagnetic, Paramagnetic, Anti- Ferromagnetic and Ferromagnetic Materials. Ferromagnetic Domain, Magnetic Materials for Ferromagnetic Tape and Memory Devices, Magnetic materials: magnetic materials used in electrical machines instruments.

UNIT – V: Special Purpose Materials **[08 Hours]**

Refractory Materials, Structural Material‘s, Radioactive Materials, Galvanization and Impregnation of materials, Non Destructive Testing: Ultrasonic Radiography, X-ray diffraction- Bragg‘s law.

Text Books/ Reference Books:

1. Material Science and Engineering – V. Raghavan
2. Electrical Engineering Materials – A.J. Dekker
3. Science of Engineering Materials and Carbon Nanotubes - C.M. Srivastava and C. Srinivasan
4. Solid State Physics – A.J. Dekker.

SUBJECT CODE BTEE25OE305B	SUBJECT Electronic Devices And Circuits	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	Understand the fundamental principles of semiconductor physics and operation of electronic devices
2	Study the working characteristics and applications of diodes, BJTs, MOSFETs, and special-purpose devices.
3	Analyze rectifier, filter, and power supply circuits.
4	Learn the operation and analysis of transistor amplifier circuits and their performance parameters.
5	Develop the ability to analyze and design basic electronic circuits for practical engineering applications.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Explain semiconductor concepts such as energy bands, charge carriers, and doping.
CO2	Analyze the operation and characteristics of electronic devices like diodes, BJTs, and MOSFETs.
CO3	Design and analyze rectifier and filter circuits for DC power supplies.
CO4	Evaluate the performance of amplifier circuits including gain, bandwidth, and efficiency.
CO5	Apply electronic devices and circuits to solve basic real-world engineering problems.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	2	1	1	–	–	–	–	1
CO2	3	3	2	2	2	2	2	1	1	1	2
CO3	3	3	2	3	2	1	1	–	–	1	2
C04	3	3	3	2	2	1	1	–	–	1	2
C05	3	2	3	2	3	2	3	2	2	2	3

UNIT - I: Semiconductor Basics: **[08 Hours]**

Bonding forces, Energy bands in Solids, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect

UNIT - II: P-N Junctions: **[08 Hours]**

Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers, Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photo detectors. Light Emitting Diode: Light Emitting materials.

UNIT - III: Bipolar Junction Transistor: **[08 Hours]**

Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

UNIT - IV: Field Effect Transistors: **[08 Hours]**

Basic JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET Two terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics.

UNIT - V: Fabrication of P-N Junctions: **[08 Hours]**

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. **Integrated Circuits:** Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements.

Text Books/ Reference Books:

1. Electronic Devices and Circuits, K. Lal Kishore B.S Publications
2. Electronic Devices and Circuits, G.S.N. Raju, I.K. International Publications, New Delhi, 2006.
3. Electronic Devices and Circuits, A. P. Godse, U.A Bakshi , Technical Publications
4. Electronic Devices and Circuits K.S. Srinivasan Anurdha Agencies
5. Ben. G. Streetman, Sanjay Kumar Banergee, "Solid State Electronic Devices", 7th Edition, Pearson Education.
6. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4th Edition, MCGraw Hill Education, 2012

SUBJECT CODE BTEE25OE305C	SUBJECT Solid State Devices & Circuits	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	Understand the fundamental concepts of semiconductor physics, including energy bands, charge carriers, and doping.
2	Study the working principles, characteristics, and applications of semiconductor devices such as diodes, BJTs, MOSFETs, and special purpose devices.
3	Analyze rectifier and filter circuits used in power supply applications.
4	Learn the operation and design of transistor amplifier circuits and their performance parameters.
5	Explore the design and applications of Operational Amplifiers, Active Filters, and Specialized ICs like the 555 Timer and PLL for analog signal processing and regulation.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Apply semiconductor physics principles to explain the behavior of various diodes and transistors.
CO2	Analyze the frequency response and stability of BJT and FET-based amplifier and oscillator circuits.
CO3	Design and evaluate Op-Amp based circuits and active filters for specific frequency-selective applications.
CO4	Implement timing and voltage regulation solutions using specialized ICs like 555 Timers and PLLs.
CO5	Demonstrate ethical engineering practices by considering component limitations and collaborating in teams to solve complex analog design problems.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	2	1	1	–	–	–	–	1
CO2	3	3	2	3	2	1	1	–	–	1	2
CO3	3	3	3	2	3	1	1	1	1	2	2
CO4	3	2	3	3	3	2	2	2	2	2	3
CO5	2	1	2	2	2	2	3	3	3	3	2

UNIT - I: Semiconductor Devices and their applications: [08 Hours]

Applications of diodes - clippers, clampers, multipliers, Types of diodes - Zener diode, Tunnel diode, schottky diode, LED, PIN diode, Photodiode etc, BJT- CB, CE, CC configurations, biasing, FET biasing, MOSFET biasing, NMOS, PMOS, CMOS, Device modeling.

UNIT - II: Signal and Power Amplifiers: [08 Hours]

Analysis of CB, CC, CE and FET amplifiers. Low and high frequency response of transistor and FET amplifier, Feedback in amplifiers, Oscillators. Transistor power amplifiers.

UNIT - III: Operational Amplifiers: [08 Hours]

The ideal Op-Amp, equivalent circuit of Op-Amp, ideal voltage transfer curve, open loop Op-Amp configurations, Op-Amp parameters, block diagram representation of feedback configurations, frequency response, high frequency Op-Amp.

UNIT - IV: Active Filters and Oscillators: **[08 Hours]**

Active filters: low pass filter, high pass filter, band-pass filters, band reject filters, all pass filters, comparators and oscillators.

UNIT - V: Specialized IC Applications: **[08 Hours]**

The 555 Timer as monostable, astable multivibrator, phase locked loops operating principles, 565 PLL applications, voltage regulators- fixed, adjustable, switching, special. Analog switch and analog multiplier.

Text Books/ Reference Books:

1. Millman, Halkias and Satyabrata Jit, "Electronic Devices and Circuits", 4th edition, Mc-Graw Hill Education (India) Private Limited, 2015.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic devices and circuit theory", 11th edition, Prentice Hall India Ltd, 2015.
3. Ramakant A. Gayakwad, "Op-Amps and linear integrated Circuits" 4th edition, Pearson Education, 2015.

SUBJECT CODE BTEE25OE305D	SUBJECT Illumination Engineering	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	Understand the fundamental concepts, terminology, and laws of illumination.
2	Study the working principles and characteristics of various light sources used in illumination systems.
3	Learn different lighting schemes and luminaire design for indoor and outdoor applications.
4	Acquire knowledge of illumination calculations and lighting design methods for residential, commercial, and industrial installations.
5	To introduce emerging technologies such as fiber optics, LASERS, and intelligent LED fixtures while emphasizing energy efficiency and sustainable lighting practices.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Analyze the human visual system and the physics of light generation to determine the required illumination levels for various human activities.
CO2	Evaluate the characteristics and design considerations of various discharge lamps (Mercury, Sodium, Metal Halide) and solid-state sources (LEDs) for specific applications.
CO3	Design electrical and optical control schemes, including ballasts, igniters, and reflectors, while adhering to international luminaire standards (IEC-598).
CO4	Perform lighting calculations for complex indoor and outdoor installations, including residential, industrial, and road lighting, using Beam Lumen and Point-by-Point methods.
CO5	Assess emerging trends in lighting technology, such as Intelligent LED systems, Fiber Optics, and Lasers, to develop innovative and sustainable lighting solutions.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	2	1	3	1	–	–	1	2
CO2	3	3	2	2	2	2	3	1	1	1	2
CO3	3	2	3	2	3	2	2	2	2	2	2
CO4	3	3	3	3	3	2	2	2	2	3	3
CO5	3	2	3	2	3	1	3	1	2	2	3

UNIT - I: Importance of Lighting in Human Life [08 Hours]

Optical systems of human eye ,Dependence of human activities on light, performance characteristics of human visual system, External factors of vision-visual acuity, contrast, sensitivity, time illuminance, colour, visual perception, optical radiation hazards, Good and bad effects of lighting & perfect level of illumination, Artificial lighting as substitute to natural light, Ability to control natural light, Production of light, physics of generation of light, Properties of light, Quantification & Measurement of Light.

UNIT - II: Light Sources: [08 Hours]

Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and nonmetals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps – Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL) High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps

UNIT - III: Electrical Control of Light Sources: **[08 Hours]**

Ballast, igniters and dimmers for different types of lamps, Photometric Control of Light Sources and their Quantification: Types of Luminaries, factors to be considered for designing luminaries Types of lighting fixtures. Optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, luminaries standard (IEC-598-Part I)

UNIT - IV: Indoor illumination design for following installations: **[08 Hours]**

Residential (Numerical),Educational institute, Commercial installation, Hospitals, Industrial lighting, Special purpose lighting schemes Decorative lighting, Theatre lighting, Aquarium, swimming pool lighting **Outdoor Lighting Design:** Road classifications according to BIS, pole arrangement, terminology, lamp and luminaire selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method. Outdoor illumination design for following installations; Road lighting (Numerical), Flood lighting (Numerical), Stadium and sports complex, Lighting for advertisement/hoardings.

UNIT - V: Modern trends in illumination: **[08 Hours]**

LED luminary designs, Intelligent LED fixtures, Natural light conduiting, Organic lighting system, LASERS, characteristics, features and applications, nonlighting lamps, Optical fiber, its construction as a light guide, features and applications.

References/Text Book:-

1. H. S. Mamak, “Book on Lighting”, Publisher International lighting Academy
2. Joseph B. Murdoch, “Illumination Engineering from Edison’s Lamp to Lasers” Publisher – York, PA: Visions Communications
3. M. A. Cayless, A. M. Marsden, “Lamps and Lighting”, Publisher-Butterworth Heinemann (ISBN978-0-415-50308-2)
4. Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002

SUBJECT CODE BTEE25PC306L	SUBJECT Electrical Measurements Lab	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 02 hr./week	Continuous Assessment: 50 Marks End Semester Exam: 50 Marks

Course Objectives:-

1	To familiarize students with the construction, working principles, and applications of basic electrical measuring instruments.
2	To develop practical skills in measuring electrical quantities such as voltage, current, power, energy, resistance, inductance, and capacitance
3	To help students understand and analyze measurement errors and ensure accuracy in readings.
4	To impart hands-on experience in selecting appropriate instruments for specific electrical measurement tasks.
5	To introduce the application of electrical transducers (RTD, LVDT) and calibration techniques to ensure reliability in industrial automated systems.

Course Outcomes:- :- At the end of the course, the student will be able to

CO1	Measure low and medium resistance accurately using Kelvin's Double Bridge by eliminating lead and contact resistance errors.
CO2	Determine unknown inductance and capacitance using Maxwell and Anderson bridges by achieving precise AC bridge balance.
CO3	Calibrate and utilize transducers like RTD and LVDT to translate temperature and displacement into measurable electrical signals.
CO4	Quantify active and reactive power in three-phase systems using the two-wattmeter and single-wattmeter methods.
CO5	Evaluate energy meter accuracy by performing calibration through both direct and power-efficient phantom loading techniques.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	3	1	1	–	1	1	1	2
CO2	3	3	2	3	2	1	1	1	1	1	2
CO3	3	2	2	2	3	2	2	2	2	2	3
CO4	3	3	3	2	2	2	2	1	1	1	2
CO5	3	3	3	3	2	3	3	2	2	3	2

List of Practical's to be performed

1. Measurement of low/medium resistance using Kelvin's double bridge.
2. Measurement of inductance and capacitance using Maxwell bridges.
3. Measurement of inductance using Anderson bridge.
4. Measurement of temperature using RTD.
5. Measurement of displacement using LVDT.
6. Measurement of active power in a balanced three phase system using two wattmeter method.
7. Measurement of reactive power in a balanced three phase system using single wattmeter method.
8. Calibration of single–phase energy meter by direct loading and phantom loading.

SUBJECT CODE BTEE25PC307L	SUBJECT Electrical Machine – I Lab.	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2Hr./Week	Continuous Assessment: 50 Marks Mid-Semester Exam: -- End Semester Exam: 50 Marks

Course Objectives:-

1	To introduce the constructional features and operational characteristics of DC generators (Shunt and Series).
2	To provide hands-on experience in controlling the speed and reversing the direction of DC motors using armature and field control methods.
3	To familiarize students with various starting mechanisms and testing procedures (Swinburne's and Load tests) for DC machines.
4	To impart knowledge on the operational behavior, polarity, and transformation ratios of single-phase transformers.
5	To develop the ability to conduct performance analysis of transformers through Open Circuit (OC), Short Circuit (SC), and direct loading tests.

Course Outcomes:-

CO1	Plot and analyze the magnetization and load characteristics of DC shunt and series generators to determine their voltage regulation capabilities.
CO2	Demonstrate speed control and rotation reversal of DC shunt motors and identify the appropriate starter for safe machine operation.
CO3	Conduct indirect (Swinburne's) and direct load tests on DC motors to evaluate their efficiency and performance under varying load conditions.
CO4	Perform polarity and turns ratio tests on single-phase transformers to ensure correct connection and transformation requirements.
CO5	Execute OC and SC tests to calculate the equivalent circuit parameters, efficiency, and voltage regulation of transformers.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	3	1	1	–	1	1	1	2
CO2	3	2	3	2	2	2	1	2	2	2	2
CO3	3	3	3	3	2	1	2	1	2	2	2
CO4	3	2	2	2	1	2	1	1	2	2	1
CO5	3	3	3	3	2	1	2	1	2	2	2

List of experiments

1. Determination of magnetization, external and internal characteristics of d. c. shunt generator.
2. Determination of magnetization, external and internal characteristics of d. c. series generator.
3. Speed control of D.C. shunt motor by armature and field control.
4. To Study the various types of D. C. motor starters.
5. To reverse the direction of rotation of D. C. shunt motor.
6. To perform the load test on D. C. shunt motor.
7. To perform the load test on D. C. series motor.
8. To perform Swinburne's test on D.C. shunt Motor.
9. To perform Polarity test on single phase transformer.
10. To find the turn ratio of single phase transformer.
11. Direct loading test on single phase transformer.
12. Open Circuit and Short Circuit test of single phase transformer to determine regulation and efficiency.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE BTEE25OE308L	SUBJECT Engineering Materials Science Lab	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical:02 per week	Continuous Assessment: 50 Marks Mid-Semester Exam: End Semester Exam: 50 Marks

Course Objectives:-

1	To provide hands-on experience in testing the dielectric strength of liquid and solid insulating materials as per Indian Standards (IS).
2	To familiarize students with the measurement techniques for High Voltage using non-contact methods like spark gaps.
3	To understand the characterization of materials by measuring the resistivity of both high-conductivity and resistive substances.
4	To analyze the magnetic properties of materials through Hysteresis Loop tracing and understand energy loss.
5	To demonstrate the practical applications of Thermoelectric effects (Seebeck and Peltier) in temperature sensing and cooling.

Course Outcomes:-

CO1	Evaluate the quality and breakdown strength of transformer oil and solid insulators to determine their fitness for industrial use.
CO2	Measure very low and high resistances accurately using specialized bridges and apply resistivity formulas to different material types.
CO3	Calibrate and use sphere gaps for high-voltage measurement, accounting for environmental correction factors.
CO4	Analyze ferromagnetic materials by plotting B-H curves and calculating hysteresis loss for efficient machine design.
CO5	Demonstrate the conversion between thermal and electrical energy using Seebeck and Peltier junctions.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	2	3	3	2	2	2	2
CO2	3	3	1	2	2	1	1	1	1	1	2
CO3	3	2	2	3	3	3	1	2	2	2	2
CO4	3	3	3	3	2	1	2	1	1	1	2
CO5	3	2	3	2	2	1	3	1	1	1	3
CO1	3	3	2	3	2	3	3	2	2	2	2

List of Experiments:-

1. Testing of insulating oil as per I.S.
2. Testing of solid insulating materials as per IS
3. Testing of power capacitors as per IS
4. Measurements of resistivity of conducting materials.
5. Measurements of resistivity of resistive material.
6. Use of spark gap for measurements of high voltage.
7. To study Seeback effect.
8. To study Peltier effect.
9. Study of hysteresis loop of ferromagnetic materials.
10. Study of various insulating materials.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE BTEE25OE308LB	SUBJECT Electronic Devices And Circuits Lab	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	Provide hands-on experience with electronic components and semiconductor devices.
2	Study the characteristics of diodes, BJTs, and MOSFETs through experimental analysis.
3	Perform rectifier, filter, and amplifier circuit experiments using solid-state devices.
4	Develop skills in using electronic instruments such as CRO, function generator, and regulated power supplies.
5	Demonstrate collaborative teamwork in troubleshooting circuit faults and adhere to ethical safety standards while handling sensitive electronic components.

Course Outcomes:-

CO1	Identify and test electronic components and semiconductor devices.
CO2	Plot and interpret V–I characteristics of diodes, BJTs, and MOSFETs
CO3	Design, assemble, and test rectifier and amplifier circuits.
CO4	Use electronic measuring instruments safely and effectively.
CO5	Analyze experimental data and prepare technical laboratory reports.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	2	2	1	–	1	1	1	1
CO2	3	3	2	3	2	1	1	1	1	2	2
CO3	3	3	3	2	3	2	2	2	2	2	2
CO4	2	2	2	3	3	3	2	2	2	2	2
CO5	3	3	2	2	1	1	1	1	2	3	2

List of Experiments

1. To study characteristics of P-N Junction Diode.
2. To study characteristics of Zener diode and zener as voltage regulator.
3. To Study of Reverse Breakdown in Zener Diodes.
4. Full-Wave and Half-Wave Rectifier Circuits with and without Filters.
5. To study characteristics of BJT in Common Emitter and Common Base Configurations.
6. To study BJT as a Switch – Observation of Cutoff and Saturation Regions.
7. To study BJT as an Amplifier – Calculation of Gain, Input/Output Impedance.
8. To study V-I characteristics of MOSFET.

SUBJECT CODE BTEE25OE305LC	SUBJECT Solid State Devices & Circuits Lab	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To provide hands-on experience in verifying the V-I characteristics of P-N Junction and Zener diodes.
2	To analyze the conversion of AC to DC using Half-Wave and Full-Wave rectifiers and study voltage stabilization using Zener regulators.
3	To investigate the input and output behavior of Bipolar Junction Transistors (BJT) and Field Effect Transistors (FET) in various configurations.
4	To determine the hybrid (h) parameters of transistors, enabling the mathematical modeling of amplification circuits.
5	To study the impact of frequency on the gain of CE, CC, and FET amplifiers and determine their effective bandwidth.

Course Outcomes:-

CO1	Plot and analyze the V-I characteristics of diodes and transistors to determine their operational parameters.
CO2	Design and test rectifier circuits and filters to evaluate ripple factors and efficiency for power supply applications.
CO3	Determine the h-parameters of a BJT from experimental data for both CB and CE configurations.
CO4	Measure the gain and bandwidth of BJT and FET amplifiers by plotting their frequency response curves.
CO5	Demonstrate technical proficiency in using laboratory instruments (CRO, Multi-meters, RPS) and documenting experimental results ethically.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	2	1	1	–	1	1	1	1
CO2	3	3	3	2	2	2	2	1	1	1	2
CO3	3	3	2	3	2	1	1	–	–	1	2
CO4	3	3	3	3	3	1	1	–	1	2	2
CO5	2	2	2	2	3	3	2	3	3	3	3

List of Experiments

1. P-N Junction Diode Characteristics (Forward and Reverse Bias).
2. Zener Diode Characteristics and study of Zener as a Voltage Regulator.
3. Half-Wave Rectifier analysis with and without Capacitor Filter.
4. Full-Wave Rectifier analysis with and without Capacitor Filter
5. Input and Output Characteristics of Transistor in Common Emitter (CE) Configuration.
6. FET Characteristics (Drain and Transfer Characteristics).
7. Frequency Response of CE Amplifier (Calculation of Bandwidth and Gain).
8. Frequency Response of CC Amplifier (Emitter Follower).

9. Frequency Response of Common Source (CS) FET Amplifier.
10. To verify the operation of op amp in Inverting & Non-inverting mode on AC input.
11. To study & measure OP-Amp parameters.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE BTEE25OE308LD	SUBJECT Illumination Engineering Lab	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To understand the fundamentals of illumination engineering and workplace lighting assessment.
2	To measure and compare illumination levels and luminous efficiency of different types of lamps.
3	To gain hands-on experience in using luxmeters and other illumination measurement techniques.
4	To study the construction and working of dimmer circuits and lighting control devices.
5	To design and implement practical lamp control and wiring circuits used in buildings.

Course Outcomes:-

CO1	Measure and evaluate illumination levels using a luxmeter for various lighting conditions.
CO2	Analyze illumination characteristics and efficiency of different lamps and luminaires.
CO3	Interpret polar curves and assess the effect of reflectors on illumination performance.
CO4	Construct and test dimmer circuits and electronic lighting control systems.
CO5	Design and implement single-point, two-point, three-point, and four-point lamp control circuits safely.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	3	2	3	1	1	2	2	2
CO2	3	3	2	2	1	2	3	–	1	1	2
CO3	3	3	2	3	2	1	1	–	1	1	1
CO4	3	2	3	2	3	2	3	2	2	2	2
CO5	2	1	3	2	2	3	2	3	3	2	2

List of Experiments

1. Conduct illumination level assessment in workplace using luxmeter.
2. Fit the given lamp in the selected mounting.
3. Interpret the polar curves of the given type of lamp and verify it using the luxmeter.
4. Measure the illumination output of different lamps (Incandescent, Fluorescent, CFL, LED, HPSV, HPMV) and compare it with their wattage.
5. Measure illumination level with and without reflectors used in the various luminaires.
6. Estimate and compare luminous efficiency of incandescent and compact fluorescent lamp.
7. Prepare light dimmer arrangement using the relevant dimmer type of transformer.
8. Identify the given types of dimmer transformer and their parts.
9. Build an electronic dimmer – Part I.
10. Build a single lamp control by single switch.
11. Build a single lamp control by two switches.

12. Build a single lamp control circuit for two point method.
13. Build a lamp control circuit for three-point method.
14. Build a lamp control circuit for four-point method.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE BTEE25HM309	Case Study/EDP Program/Startup Activity	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 4 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam:

Course Objectives:-

1	Understand the fundamentals of entrepreneurship and startup ecosystems.
2	Analyze real-world business case studies to identify challenges and strategic solutions.
3	Develop entrepreneurial skills through experiential learning and project-based activities.
4	Explore business planning, market analysis, and financial modeling techniques.
5	Apply innovation and design thinking to create viable startup ideas or social enterprises.

Course Outcomes:-

CO1	Demonstrate understanding of entrepreneurial concepts and dynamic startup.
CO2	Analyze and present case studies with strategic insights.
CO3	Design and execute business plans using EDP frameworks.
CO4	Apply innovation and problem-solving skills to real-world challenges.
CO5	Collaborate effectively to develop and pitch startup ideas or social ventures.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	2	1	1	2	2	2	2	2	2
CO2	1	2	2	1	1	2	2	2	2	2	2
CO3	1	2	2	1	1	2	2	2	2	2	2
CO4	1	2	2	1	1	2	2	2	2	2	2
CO5	1	2	2	1	1	2	2	2	2	2	2

Case Study Methodology

- Selecting and analyzing business cases
- Identifying problems, stakeholders, and solutions
- Presentation and documentation techniques

Entrepreneurship Development Program (EDP)

- Business model canvas
- Market research and feasibility analysis
- Financial planning and resource mobilization

Startup Activity and Incubation

- Ideation and validation
- MVP (Minimum Viable Product) development
- Pitching, funding, and scaling strategies

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VEC310	BASICS OF HUMAN RIGHTS	01

Teaching Scheme	Examination Scheme
Theory: 1 hr./week	Continuous Assessment: 50 Marks
Tutorial :	Mid-Semester Exam: -
Practical:	End Semester Exam:

Course Objectives:-

1	To train the young minds facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture.
2	To give knowledge of the major "signposts" in the historical development of human rights, the range of contemporary declarations, conventions, and covenants.
3	To enable them to understand the basic concepts of human rights (including also discrimination, equality etc.), the relationship between individual, group, and national rights.
4	To develop sympathy in their minds for those who are denied rights.
5	To make the students aware of their rights as well as duties to the nation.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Students will be able to understand the history of human rights.
CO2	Students will learn to respect others caste, religion, region and culture.
CO3	Students will be aware of their rights as Indian citizen.
CO4	Students will be able to understand the importance of groups and communities in the society.
CO5	Students will be able to realize the philosophical and cultural basis and historical perspectives of human rights.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	1	1	1	3	3	2	2	1	2
CO2	1	1	1	1	1	3	3	2	2	1	2
CO3	1	1	1	1	1	3	3	2	2	1	2
CO4	1	1	1	1	1	3	3	2	2	1	2
CO5	1	1	1	1	1	3	3	2	2	1	2

Course Contents:

Unit – I: Basic Concepts **[03 Hours]**

The Basic Concepts: - Individual, group, civil society, state, equality, justice, Human Values, Human rights and Human Duties: - Origin, Contribution of American bill of rights, French revolution, Declaration of independence, Rights of citizen, Rights of working and exploited people.

Unit – II: Fundamental rights and economic programme **[03 Hours]**

Fundamental rights and economic programme, Society, religion, culture, and their inter relationship, Impact of social structure on human behavior, Social Structure and Social Problems: - Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labor.

Unit – III: Migrant worker **[03 Hours]**

Migrant workers and human rights violations, human rights of mentally and physically challenged, State, Individual liberty, Freedom and democracy, NGOs and human rights in India: - Land, Water, Forest issues.

Unit – IV: Human rights in Indian constitution and law **[03 Hours]**

Human rights in Indian constitution and law:- i) The constitution of India: Preamble, ii) Fundamental rights, iii) Directive principles of state policy, vi) Fundamental duties, v) Some other provisions.

Unit – V: Universal declaration **[03 Hours]**

Universal declaration of human rights and provisions of India, Constitution and law, National human rights commission and state human rights commission.

Text/Reference Books:

1. Shastry T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
2. Nirmal C. J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

SUBJECT CODE BTEE25VEC311	SUBJECT Indian Constitution – Value Education	CREDITS 01

Teaching Scheme	Examination Scheme
Theory: 1 hr./week Tutorial : Practical:	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam:

Course Objectives:-

1	Understand the historical background and philosophical foundations that shaped the framing of the Indian Constitution.
2	Explain the structure, organization, and functioning of the Indian Government at both Union and State levels.
3	Comprehend the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties of Indian citizens.
4	Analyze the distribution of powers between the Union and the States, the emergency provisions, and the role of various constitutional bodies.
5	Develop awareness of constitutional values, ethical governance, and the responsibilities of citizens in upholding the Constitution of India.

Course Outcomes:-

CO1	Explain the historical evolution and salient features of the Indian Constitution.
CO2	Describe the structure, powers, and functions of the various organs of the Government.
CO3	Interpret the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties of citizens.
CO4	Analyze the functioning of constitutional bodies and evaluate the mechanisms of governance.
CO5	Demonstrate responsible citizenship by applying constitutional values and principles in day-to-day life.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	1	1	1	3	3	2	2	1	2
CO2	1	1	1	1	1	3	3	2	2	1	2
CO3	1	1	1	1	1	3	3	2	2	1	2
CO4	1	1	1	1	1	3	3	2	2	1	2
CO5	1	1	1	1	1	3	3	2	2	1	2

UNIT – I: Introduction to the Constitution of India [03 Hours]

Historical Background and Making of the Constitution, Constituent Assembly: Composition, Committees, and Drafting Process, Preamble: Meaning, Components, and Significance, Salient Features of the Indian Constitution, Sources and Influences from Other Constitutions.

UNIT – II: Structure of the Union and State Governments [03 Hours]

Union Government: President, Vice-President, Prime Minister, Council of Ministers, Parliament: Composition, Powers, and Functions, State Government: Governor, Chief Minister, State Legislature, Judiciary: Supreme Court, High Courts, and Subordinate Courts, Federal System: Centre-State Relations and Inter-State Relations.

UNIT – III: Fundamental Rights, Directive Principles and Duties [03 Hours]

Fundamental Rights: Nature, Scope, and Limitations (Articles 12–35), Directive Principles of State Policy: Meaning, Classification, and Implementation (Articles 36–51), Fundamental Duties: Origin, List, and Importance (Article 51A), Relationship between Rights, Duties, and DPSPs, Role of Judiciary in Protecting Fundamental Rights.

UNIT – IV: Constitutional Bodies and Governance [03 Hours]

Election Commission of India, Finance Commission, NITI Aayog, and Comptroller & Auditor General (CAG), Union Public Service Commission (UPSC) and State PSCs, National Human Rights Commission, Women's Commission, and other statutory bodies, Local Self-Government: 73rd and 74th Amendments – Panchayati Raj and Municipalities.

UNIT – V: Amendments, Emergency, and Constitutional Values [03 Hours]

Procedure for Constitutional Amendments (Article 368), Major Amendments (1st, 42nd, 44th, 73rd, 74th, 86th, 101st), Emergency Provisions (Articles 352–360): Types and Effects, Constitutional Values and Ethics in Governance, Role of Citizens in Upholding Constitutional Morality and National Integration.

References/Text Book:-

1. D.D. Basu, Introduction to the Constitution of India, LexisNexis.
2. M. Laxmikanth, Indian Polity, McGraw Hill.
3. Subhash Kashyap, Our Constitution, National Book Trust.
4. P.M. Bakshi, The Constitution of India.
5. Granville Austin, The Indian Constitution: Cornerstone of a Nation.
6. Durga Das Basu, Shorter Constitution of India.

SUBJECT CODE BTEE25VEC312	Field Visit/ Special Study/ Internship/Social Activity Project/Community Initiative	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 4 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam:

Course Objectives:-

1	To expose students to real-world industrial, organizational, or community environments.
2	To develop the ability to observe, analyze, and interpret field-based data.
3	To cultivate professional behavior, teamwork, and ethical responsibility in practical settings.
4	To encourage students to design and execute socially relevant or discipline-specific projects.
5	To enhance communication skills through report writing, documentation, and presentations.

Course Outcomes:- At the end of the course, the student will be able to

CO1	Analyze and interpret field-based or organizational data in relation to academic concepts.
CO2	Demonstrate practical skills and professional behavior in real-world or community settings.
CO3	Design and implement socially relevant or discipline-specific projects with measurable outcomes.
CO4	Communicate findings and experiences effectively through written reports and oral presentations.
CO5	Reflect critically on personal growth, societal impact, and the learning process.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	2	2	1	1	3	2	3	3	2	3
CO2	1	2	2	1	1	3	2	3	3	2	3
CO3	1	2	2	1	1	3	2	3	3	2	3
CO4	1	2	2	1	1	3	2	3	3	2	3
CO5	1	2	2	1	1	3	2	3	3	2	3

- Orientation & planning
- Selection
- Execution
- Documentation & presentation

SUBJECT CODE BTEE25PC401	SUBJECT Electrical Machine – II	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 Hr./Week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To understand the fundamental construction, working principles, and EMF generation of Three-Phase Synchronous Generators.
2	To analyze the operational characteristics of Synchronous Motors, focusing on excitation effects and power factor improvement.
3	To study the construction and torque-slip characteristics of Three-Phase Induction Motors as generalized transformers.
4	To evaluate various Starting and Speed Control methods for induction motors to meet specific industrial requirements.
5	To introduce the concepts of Fractional Horsepower and Special Purpose Motors for domestic and precise control applications.

Course Outcomes:-

CO1	Calculate the voltage regulation of alternators using various methods and explain the synchronization process.
CO2	Analyze the behavior of synchronous motors under varying load and excitation conditions using V-curves.
CO3	Evaluate the performance parameters of 3-phase induction motors including torque, slip, and power flow relations.
CO4	Compare and Select appropriate starting and speed control techniques (like VVVF) for different industrial drives.
CO5	Discuss the operation and applications of single-phase and special motors like BLDC, Stepper, and Universal motors.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	1	1	1	2	1	1
CO2	3	3	2	2	1	1	2	1	2	1	1
CO3	3	3	2	2	1	1	1	1	2	1	1
C04	3	3	3	3	3	2	1	1	2	2	2
C05	3	2	2	1	2	2	1	1	1	1	2

UNIT – I: Three Phase Synchronous Generator (Alternator) **[08 Hours]**

Construction, Operating principle, Winding factors, E.M.F. equation, Relations between speed and frequency, Synchronous reactance, Armature reaction at various power factors,

Voltage regulation: Direct loading method and synchronous impedance method,

Synchronization of alternators: Definition, Necessity and conditions.

UNIT – II: Three Phase Synchronous Motor **[08 Hours]**

Operating principle, Methods of Starting, Motor at no load and on Load with constant excitation, Effect of increased load with constant excitation, Effect of changing excitation on constant load, Operation of synchronous motor at constant power, Hunting, Application.

UNIT – III: Three Phase Induction Motor **[08 Hours]**

Construction, Production of rotating magnetic field, Working principle, Synchronous speed and rotor speed, Slip, Frequency of rotor current, Measurement of slip, Starting and running torque, Conditions for maximum starting and running torques, Torque – slip characteristics, Relation between rotor input, rotor copper loss and total mechanical power developed by the rotor, Induction motor as generalized transformer.

UNIT – IV: Starting and Speed Control of Three Phase Induction Motor **[08 Hours]**

Direct on Line (DOL), Primary resistance starter, auto transformer starter, star delta starter, Soft starter, Rotor resistance starter, Reversal of rotation, Applications.

Speed control of Induction Motor :– Pole changing, Variable Frequency or VVVF Control, Voltage control, Rotor resistance control, Injection of e.m.f. in rotor circuit, Cascade operation.

UNIT – V: Fractional Horse Power Motors **[08 Hours]**

Single phase induction motors :– Construction, Double revolving field theory, Types, Applications.

Special purpose motors :– Universal motor, Stepper motors, Reluctance motors, Brushless D.C. (BLDC) Motor.

References/Text Book:-

1. P. C. Sen., "Principles of Electric Machines and Power Electronics", John Wiley and Sons Inc.
2. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata Mc-Graw Hill Publication.
3. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers.
4. B. L. Theraja, "Electrical Technology", Vol. – II, S. Chand Publications.
5. B. R. Gupta, "Fundamental of Electric Machines", New Age International Publication.
6. S. K. Bhattacharya, "Electrical Machines", Tata McGraw hill, Delhi.
7. Bhag S. Guru, Husayin R.Hizirggly, "Electric Machinery & Transformers", Oxford University press, New York.

SUBJECT CODE BTEE25PC402	SUBJECT Network Theory	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To apply Graph Theory and matrix methods to represent and solve complex electrical network topologies.
2	To analyze DC and AC circuits using fundamental Network Theorems and understand time/frequency domain responses.
3	To evaluate the Transient Response of R-L, R-C, and R-L-C circuits by solving first and second-order differential equations.
4	To utilize Laplace Transforms as a tool for converting differential equations into algebraic equations for easier circuit analysis.
5	To characterize networks as Two-Port systems using Z, Y, and Transmission (ABCD) parameters and analyze pole-zero plots.

Course Outcomes: -

CO1	Formulate Incidence, Tie-set, and Cut-set matrices to solve large-scale network problems using nodal and mesh analysis.
CO2	Verify and Apply network theorems (Thevenin's, Norton's, Tellegen's) to simplify and solve complex linear circuits.
CO3	Determine the transient and steady-state behavior of circuits by evaluating initial/final conditions and solving differential equations.
CO4	Transform time-domain circuit problems into the s-domain using Laplace Transforms to analyze circuit stability and response.
CO5	Calculate two-port network parameters and interpret the system's transfer functions through pole-zero configurations.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	2	1	1	1	1	2	1	1
CO2	3	3	3	2	1	1	1	1	2	2	1
CO3	3	3	2	3	2	1	1	1	1	1	1
CO4	3	3	3	3	3	1	1	1	2	1	1
CO5	3	3	2	2	2	2	2	1	2	2	2
CO6	3	3	2	2	1	1	1	1	2	1	1

UNIT – I: Network Topology **[08 Hours]**

Graph Theory, Incidence Matrix, and Fundamental Loop Matrix, and Fundamental Cut set Matrix, Mesh and Nodal Analysis, Star-Delta Transformation, source transformation, Duality.

UNIT – II: Network Theorems **[08 Hours]**

Superposition, Thevenin's, Norton's, Maximum power transfer. Tellengen's Theorem (AC and DC). Time and Frequency domain analysis of circuits for step, ramp, exponential and damped exponential inputs.

UNIT – III: Transient Response Analysis in circuit **[08 Hours]**

Initial and final condition of circuit, procedure for evaluating initial conditions, solution of first and Second order differential equations of series & parallel R-L, R-C, R-L-C circuits, Time constant, General & particular solutions, Particular integral & complimentary functions, Solution of D.C. resistive network, writing loop equations, Node equations directly in matrices form Numerical.

UNIT – IV: Application of Laplace's Transform **[08 Hours]**

Standard test input signal- Unit step, Impulse & ramp functions and their Laplace transform, Solutionof differential equation using Laplace transform, solve of R-L, R-C, R-L-C circuits using Laplace transform, Transient and steady state response of RL and RC circuit to various functions using Laplace transform.

UNIT – V: Two port network: **[08 Hours]**

Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets

References/Text Book:-

1. Alexander and Sadiku, Electric Circuits, McGraw Hill Education, M. E. Van Valkenburg, Network Analysis, Prentice Hall,.
2. K.V.V. Publishing Murthy and M.S.Kamath, Basic Circuit Analysis, Jaico,
3. Mac.E, Van Valkenburg, "Network Analysis"
4. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.

SUBJECT CODE (BTEE25PC403)	SUBJECT POWER SYSTEM – I	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: 02 hr./week	Continuous Assessment: 20 Marks
Tutorial:	Mid-Semester Exam: 20 Marks
Practical:	End Semester Exam: 60 Marks

Course Objectives: -

1	To introduce the layout and operating principles of Thermal, Hydro, and Nuclear power stations.
2	To impart knowledge on the calculation of electrical parameters (L and C) for various transmission line configurations.
3	To provide a technical understanding of mechanical factors such as sag, tension, and insulator performance.
4	To analyze the performance of short, medium, and long transmission lines using generalized constants.
5	To explain the design considerations and load calculation methods for AC and DC distribution systems.

Course Outcomes: -

CO1	Explain the construction and operational logic of different power plants and their role in the grid.
CO2	Calculate inductance and capacitance of transmission lines using GMD and GMR concepts for various spacings.
CO3	Analyze the mechanical stability of overhead lines by calculating sag, tension, and string efficiency.
CO4	Evaluate the performance (efficiency and regulation) of short, medium, and long transmission lines using ABCD constants.
CO5	Design and solve numerical problems related to voltage drops and load balancing in AC/DC distribution networks.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	1	3	3	2	2	2	2
CO2	3	3	2	2	2	1	1	1	1	1	1
CO3	3	3	3	2	1	2	1	1	2	1	2
CO4	3	3	2	3	2	1	1	1	1	2	1
CO5	3	2	3	2	1	2	1	1	2	2	3

Unit – I: Electrical Power Generation [06 Hours]

Introduction, Typical Layout of an Electrical Power System–Introduction to different sources of energy. Construction and working of thermal power plants, Hydro power station, Nuclear Power Plant with neat block diagram of major parts.

Unit – II: Electrical Design of Overhead Transmission Lines [06 Hours]

Line conductors, inductance and capacitance of single phase and three phase lines with symmetrical and unsymmetrical spacing, concept of GMD and GMR, Composite conductors-transposition, bundled conductors and effect of earth on capacitance. Skin effect, proximity effect, Ferranti Effect.

Corona: introduction, Factors affecting corona loss and methods of reducing corona loss, Disadvantages of corona, Numerical.

Unit – III: Mechanical Design of Transmission Lines [06 Hours]

Types of conductors, Choice of conductor materials, stranded copper & ACSR conductor, Insulation consideration, Different types of insulator, supports, distribution of voltage across the insulator string, String efficiency, Effect of wind & ice coating on transmission line, sag due to equal & unequal supports with their derivation, Numerical.

Unit – IV: Performance of Transmission Lines [06 Hours]

Classification of overhead transmission lines, performance of single phase short transmission lines, three phase short transmission lines, effect of load power factor on regulation and efficiency, different types of medium transmission line, Analysis of long transmission lines, generalized constantoftransmissionline,determinationofgeneralizedconstantoftransmissionlines,percentageregulation,Transmissionefficiency,numerical based on above.

Unit – V: AC & DC Distribution [06 Hours]

Classification of Distribution system, Requirement of distribution system, design consideration in distribution system. AC Distribution: Calculations, method of Solving AC Distribution problem, three phase unbalanced load, four wire unbalanced star connected load, ground detector, DC Distribution: types, DC distribution calculation and three wire DC system.

References/Text Book: -

1. Gupta B. R. “Power Plant Engineering”.(Eurasia publications)
2. Nag P. K. “Power Plant Engineering”,(Tata McGraw Hill Publications)
3. Kothari Nagrath, “Electric Power System”, (Tata McGraw Hill Publications)
4. Wadhva S. L., “Electric Power System”,(Tata McGraw Hill Publications)
5. Stevension W. B., “Power System”, (English Language Book Society publications)

SUBJECT CODE BTEE25MD404	SUBJECT Renewable Energy Sources	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To provide a fundamental understanding of Solar Energy harvesting through various collectors and storage technologies.
2	To explain the principles of Wind Energy conversion systems and the criteria for optimal site selection and machine classification.
3	To explore Biomass and Biogas technologies, focusing on the chemical conversion processes and plant designs (Fixed dome vs. Floating drum).
4	To analyze Geothermal Energy resources and the specific prime movers and materials required for power conversion in hydrothermal fields.
5	To introduce Ocean Energy technologies, including OTEC (Ocean Thermal Energy Conversion), Tidal, and Wave energy systems.

Course Outcomes:-

CO1	Identify and Describe the availability and potential of various renewable energy sources like solar, wind, and biomass.
CO2	Analyze the performance of solar collectors and wind turbines to determine their efficiency in power generation.
CO3	Design simple biogas plants and biomass gasifiers based on site-specific requirements and feed-stock availability.
CO4	Evaluate the technical feasibility of geothermal and ocean energy systems (OTEC, Tidal) for specific geographic locations.
CO5	Assess the environmental and socio-economic impact of transitioning from fossil fuels to non-conventional energy sources.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	3	3	1	1	1	1	3
CO2	3	3	2	2	2	1	2	1	1	1	1	3
CO3	3	2	3	2	1	2	2	1	2	2	2	3
CO4	3	2	2	2	2	1	2	1	1	1	1	3
CO5	2	1	1	1	1	3	3	3	2	2	2	2

UNIT – I: Introduction to Energy Sources [08 Hours]

Energy sources and their availability, non-conventional sources, advantages of renewable energy sources, and prospects of renewable energy sources. Solar Energy: Solar energy collectors – flat plate collectors and concentrating collectors, solar energy storage systems – mechanical, electrical, chemical and electro-magnetic, solar pond, applications of solar energy – solar water heating, solar distillation, solar cooking

UNIT – II: Wind Energy **[08 Hours]**

Basic principles of wind energy conversion, site selection considerations, basic components of Wind Energy Conversion System (WECS), classification of WEC systems, wind energy collectors – horizontal axis machines and vertical axis machines, generating systems, applications of wind energy. Geothermal Energy: Geothermal sources, hydrothermal resources – vapour-dominated and liquid-dominated systems, hybrid plants – geothermal preheat and fossil superheat; applications of geothermal energy, advantages and disadvantages of geothermal energy

UNIT – III: Energy from Biomass **[08 Hours]**

Biomass conversion technologies, photosynthesis, biogas generation, factors affecting biogas generation, classification of biogas plants – floating drum plants and fixed dome plants, selection of site for biogas plant, utilization of biogas; Methods for obtaining energy from biomass, biomass gasification, classification of biomass gasifiers, fixed bed gasifiers and fluidized bed gasifiers, applications of gasifiers, advantages and limitations of gasifiers.

UNIT – IV: Geothermal Energy **[08 Hours]**

Geothermal Energy Estimation of Geothermal energy, Nature of Geothermal fields, Geothermal resources, Hydrothermal resources, Vapour-dominated systems, liquid-dominated systems, Prime Movers for Geothermal Energy conversion, Material Selection for Geothermal Power plants, Advantages & Disadvantages of Geothermal Energy, Applications of Geothermal Energy.

UNIT – V: Oceans Energy **[08 Hours]**

Energy from the oceans: Ocean thermal energy conversion-open cycle and closed cycle systems, Heat Exchangers, Site Selection. Energy from tides – basic principle of tidal power, components of tidal power plants, single basin and double basin systems, ocean waves – wave energy conversion systems, advantages & limitations of Tidal Power Generation.

Reference/Text Book:

1. G.D. Rai, Non-conventional sources of energy, 6th Edition, Khanna Publishers, 2017.
2. D.P. Kothari, R. Rakesh and K.C. Singal, Renewable Energy Resources and Emerging Technologies, 3rd Edition, Prentice India Pvt. Ltd, 2022.
3. G.S. Sawhney, Non-Conventional Energy Sources, 1st Edition, Prentice India Pvt. Ltd, 2012.
4. G.N. Tiwari and M.K. Ghosal, Renewable Energy Resources: Basic Principles and Applications, 1st Edition, Alpha Science International Ltd, 2005.
5. S P Sukhatme, Solar Energy, Tata McGraw-Hill Publishing Company Limited, Second Edition.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25OE405A	**Analog and Digital Electronics**	**02**

Teaching Scheme	Examination Scheme
Theory: 2 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To understand the physics and operational characteristics of PN Junction Diodes and BJTs in various configurations.
2	To analyze the linear and non-linear applications of Operational Amplifiers in signal processing.
3	To master Number Systems and Boolean Algebra for the simplification of digital logic.
4	To design Combinational Logic Circuits like adders and subtractors using universal gates and K-Maps.
5	To explore the architecture and timing of Sequential Logic Circuits, including flip-flops, counters, and registers.

Course Outcomes: -

CO1	Explain the characteristics of diodes and BJTs and evaluate their performance as switches and amplifiers.
CO2	Analyze Op-Amp circuits to perform mathematical operations like integration, differentiation, and comparison.
CO3	Execute inter-conversion between number systems and perform binary arithmetic using complement methods.
CO4	Minimize Boolean expressions using K-Maps and design optimized combinational circuits like half/full adders.
CO5	Develop sequential circuits including asynchronous counters and various shift registers (SISO, SIPO, PIPO).

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	1	1	1	1	1	1	1
CO2	3	3	2	2	2	1	1	1	1	1	1
CO3	3	2	2	1	1	1	1	1	1	1	1
CO4	3	3	3	2	2	2	1	1	2	2	2
CO5	3	3	3	2	3	2	2	1	2	1	2

UNIT – I: Basic Semiconductor Devices **[06 Hours]**

PN junction diode: Construction, working principle and V-I characteristics, BJT: Construction, working principle, different configuration of BJT, input output characteristics of BJT, relation between α and β, transistor as a switch, transistor as an amplifier. CE, CB and CC amplifiers; R-C coupled amplifier.

UNIT – II: Operational Amplifier **[06 Hours]**

Block diagram of Op-Amp and properties, Virtual ground, Common mode rejection, differential and common mode operation, Inverting &Non Inverting Amplifier, Op-Amp applications: inverting, integrator, differentiator, summer and comparator.

UNIT – III: Number System **[06 Hours]**

Number system: Decimal system, Binary number system, Hexadecimal number system, Octal number system; Inter conversion of numbers of different systems; Binary addition and subtraction, Binary multiplication and division, l's complement and 2's complement methods of subtraction, 1's complement method, 2's complement method,

UNIT – IV: Boolean algebra and Combinational Logic **[06 Hours]**

Boolean algebra, Laws of Boolean algebra, De Morgan's theorem, Kamaugh mapping, Minterm, Drawing of map and its reduction, Two variable map, Three variable map, Four variable map, all logic gates, derivation of logic gates from universal gates, Binary adder, Binary half adder, Binary full adder.

UNIT – V: Sequential Logic **[06 Hours]**

Flip-flop, D flip flop, S-R flip flop, J-K flip flop, Asynchronous counter, Two-bit counter, Three-bit asynchronous binary counter, Four bit asynchronous down counter, Register, Memory register, Shift register, SISO shift register, Serial-in parallel out (SIPO) shift register, Parallel-in parallel-out (PIPO) shift register, Parallel-in serial out (PISO) shift register.

References/Text Book:-

1. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.
2. Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.
3. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
4. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
5. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2000

SUBJECT CODE	SUBJECT	CREDITS
BTEE25OE405B	**Signals and System**	**02**

Teaching Scheme	Examination Scheme
Theory: 2 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To introduce the mathematical representation and classification of Continuous-Time (CT) and Discrete-Time (DT) signals.
2	To establish the fundamental properties of systems, focusing on Linearity and Time-Invariance (LTI).
3	To provide proficiency in Convolution (Integral and Sum) to determine system behavior in the time domain.
4	To apply transformation techniques (Fourier, Laplace, and Z-transforms) to analyze signals and systems in the frequency domain.
5	To understand the Sampling Theorem and state-variable representations for modeling complex engineering systems.

Course Outcomes: -

CO1	Classify and perform mathematical operations on basic signals like step, ramp, impulse, and exponential functions.
CO2	Analyze LTI systems by evaluating causality, stability, and performing convolution in both CT and DT domains.
CO3	Evaluate the frequency spectrum of signals using Fourier Series and Fourier Transforms.
CO4	Solve differential and difference equations using Laplace and Z-transforms to determine system transfer functions.
CO5	Model complex systems using state-variable equations and block diagram representations for engineering applications.

Mapping of Course Outcome with Program Outcomes

Course Outcome	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	1	1	1	1	1	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1
CO3	3	3	2	2	2	1	1	1	1	1	1
C04	3	3	2	2	3	1	1	1	2	1	1
C05	3	3	3	3	3	2	2	1	2	2	2

UNIT – I: Classification of Signals **[06 Hours]**

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random singals,

UNIT – II: Classification of Systems **[06 Hours]**

CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.

UNIT – III: Analysis of Continuous Time Signals **[06 Hours]**

Fourier series analysis, Spectrum of C.T. singals, Fourier Transform and Laplace Transform in Signal Analysis, **Linear Time Invariant –Continuous Time Systems:** Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response, Fourier and Laplace transforms in analysis, State variable equations and matrix representation of systems

UNIT – IV: Analysis of Discrete Time Signals **[06 Hours]**

Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform.

UNIT – V: Linear Time Invariant - Discrete Time Systems **[06 Hours]**

Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms, State variable equations and matrix representation of systems.

References/Text Book:-

1. Allan V. Oppenheim, S. Wilsky and S. H. Nawab, Signals and Systems, Pearson Education, 2007.
2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007
3. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007
4. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007.
5. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons, Inc, 2004.
6. Robert A. Gabel and Richard A. Roberts, Signals & Linear Systems, John Wiley

SUBJECT CODE BTEE25OE405C	SUBJECT Embedded System	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: 2 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To introduce the architectural design of embedded systems
2	To teach the principles of interfacing sensors and actuators through ADC
3	To provide an understanding of Real-Time Operating Systems (RTOS)
4	To analyze Embedded Networking protocols like I2C
5	To develop skills in System Design by analyzing real-world applications like set-top boxes

Course Outcomes: -

CO1	Describe the ARM architecture, memory mapping, and bus configurations used in modern SoC (System on Chip) designs.
CO2	Design interfacing circuits for analog-to-digital conversion and motor control (Servos/Steppers) using H-Bridges.
CO3	Analyze RTOS task scheduling and synchronization mechanisms to meet strict real-time performance constraints.
CO4	Implement communication between embedded devices using standard protocols like I2C, CAN, and Ethernet.
CO5	Formulate comprehensive system specifications and hardware requirements for complex consumer electronics

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	1	1	1	1	1	1	1	2
CO2	3	3	3	2	3	1	1	1	2	1	2
CO3	3	3	2	3	2	1	1	1	1	1	1
C04	3	3	2	2	2	2	1	1	2	2	2
C05	3	3	3	2	3	2	2	3	3	2	3

UNIT – I: Embedded System Architectures **[06 Hours]**

Introduction, Components of Embedded Systems ARM processor - architectural design -memory organization -data operation-bus configurations. System on-chip, scalable bus architectures, Design example: Alarm clock, hybrid architectures.

UNIT – II: Sensor and Actuator I/O **[06 Hours]**

ADC, DAC, timers, Servos, Relays, stepper motors, H-Bridge, port.

UNIT – III: Real time operating systems (RTOS) **[06 Hours]**

Real time kernel – OS tasks – task states – task scheduling –interrupt processing – clocking communication and synchronization – control blocks – memory requirements and control – kernel services

UNIT – IV: Embedded Networks **[06 Hours]**

Distributed Embedded Architecture – Hardware and Software Architectures, Networks for embedded systems– I2C, CAN Bus, Ethernet, Internet, Network-based design–Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller

UNIT – V: System Design **[06 Hours]**

Specification, Requirements and Architectural design of PBX systems, Set-top box, Ink-jet printer, Laser printer, Personal digital Assistants.

Embedded Hardware: memory map, i/o map, interrupt map, processor family, external peripherals, memory- RAM , ROM, types of RAM and ROM, memory Testing, CRC, Flash memory.

References/Text Book:-

1. Sloss Andrew N, Symes Dominic, Wright Chris, ―ARM System Developer's Guide: Designing and Optimizing, Morgan Kaufman Publication,2004.
2. Raj Kamal, Embedded Systems – Architecture: Programming and Design, Tata McGraw Hill Education, 3rd ed., 2003.
3. Peckol, Embedded system design, John Wiley & Sons.
4. Lyla B Das, Embedded Systems-an integrated approach, Pearson.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25OE405D	**Electromagnetic Engineering**	**2**

Teaching Scheme	Examination Scheme
Theory: 2 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To develop a strong mathematical foundation in Vector Calculus and coordinate systems (Rectangular, Cylindrical, and Spherical).
2	To analyze the behavior of Static Electric Fields using Coulomb's Law, Gauss's Law, and the concept of Electric Potential.
3	To evaluate the interaction of EM fields with Conductors and Dielectrics, and to solve for capacitance using Poisson's and Laplace's equations.
4	To study Magnetostatics, focusing on the laws of Biot-Savart and Ampere, and the concept of magnetic flux density.
5	To understand Antenna Fundamentals, radiation patterns, and the design of antenna arrays for modern communication system.

Course Outcomes: -

CO1	Apply vector calculus and coordinate transformations to formulate and solve mathematical models for electromagnetic field problems.
CO2	Compute electric and magnetic field parameters for diverse charge and current distributions using fundamental laws.
CO3	Evaluate EM fields at material interfaces and solve boundary-value problems using Poisson's and Laplace's equations.
CO4	Design antenna systems and arrays by analyzing radiation patterns while ensuring compliance with safety standards.
CO5	Demonstrate professional ethics and collaborative skills by reviewing the societal and environmental impact of EM radiation.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	2	2	1	1	1	1	1	1
CO2	3	3	2	2	1	1	1	1	1	1	1
CO3	3	2	2	1	1	1	1	1	1	1	1
C04	3	2	3	2	2	2	2	2	1	1	2
C05	1	1	1	1	1	2	3	3	3	2	2

UNIT – I: Vector calculus **[06 Hours]**

Vector algebra including addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems namely rectangular, cylindrical and spherical, vector calculus differentiation, partial differentiation, integration, vector operator del,

gradient, divergence and curl, integral theorems of vectors, conversion of a vector from one coordinate system to another

UNIT – II: Static electric field **[06 Hours]**

Coulomb's law, electric field intensity, electrical field due to point charges, line charge distributions, surface charge distributions and volume charge distributions, Gauss law and its applications, absolute electric potential, potential difference.

UNIT – III: Conductors, dielectrics and capacitance **[06 Hours]**

Current and current density, Ohm's law in point form, continuity of current, boundary conditions of perfect dielectric materials, permittivity of dielectric materials, capacitance, capacitance of a two wire line, Poisson's equation, Laplace's equation, solution of Laplace and Poisson's equation, dipole and its electric field and dipole-moment, energy-density in electrostatic field, concept of current-density, current continuity equation, properties of conductors, boundary conditions between conductor and free-space, boundary conditions between two perfect dielectrics, capacitance between parallel plates, capacitance between co-axial cable and spherical shells, energy stored in capacitors, Poisson's and Laplace's equation's to calculate potential capacitance and electric field

UNIT – IV: Magnetostatics **[06 Hours]**

Magnetostatics :- Biot-Sarverts law and its vectorial form, Ampere's Circuital law, Application of Ampere's Circuital law to co-axial cable, Curl operator, Magnetic flux density, Scalar and Vector magnetic potential, Stoke's theorem, Lorentz's Force equation, Energy stored in magnetic field

UNIT – V: Antenna fundamentals **[06 Hours]**

Radiation intensity, directive gain and directivity, power gain and efficiency, effective length, effective aperture, radiation resistance, reciprocity between transmitting and receiving antennas, vector retarded potential, radiation pattern, antenna arrays including broadside arrays, end-fire array, binomial array, Tchebyscheff array, principle of pattern multiplication, types of antennas including folded dipole, Yagi-Uda antenna, horn antenna, parabolic antenna and Cassegrain antenna.

Text Books/Reference books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd
3. R. K. Shevgaonkar, "Electromagnetic Waves", McGraw Hill
4. W. Hayt, "Engineering Electromagnetic", McGraw Hill Education, 8th edition, 2012.
5. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
6. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25AE406L	**Network Theory Lab**	**01**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical:02 per week	Continuous Assessment: 50 Marks Mid-Semester Exam: End Semester Exam: 50 Marks

Course Objectives:-

1	To physically verify fundamental network theorems (KCL, KVL, Superposition, Thevenin's) using breadboards and discrete components.
2	To analyze the Maximum Power Transfer condition and determine the efficiency of power delivery in resistive circuits.
3	To observe and measure the Transient Response of first-order (RL and RC) circuits using Oscilloscopes.
4	To investigate the phenomenon of Resonance in series and parallel RLC circuits and determine the Quality Factor (Q) and Bandwidth.
5	To characterize and verify the Z and Y parameters of two-port networks through open-circuit and short-circuit tests.

Course Outcomes:-

CO1	Demonstrate proficiency in using laboratory equipment like Multimeters, CROs, and Function Generators to measure circuit variables.
CO2	Validate theoretical network theorems by comparing calculated values with practical experimental data.
CO3	Analyze the time-domain behavior of energy storage elements (L and C) during switching operations.
CO4	Determine the frequency response and resonant frequencies for various RLC configurations.
CO5	Calculate and model two-port network parameters based on experimental measurements.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	3	3	1	1	1	3	2	2
CO2	3	3	2	3	1	1	1	1	3	2	1
CO3	3	3	2	3	2	1	1	1	3	2	1
CO4	3	3	3	3	2	1	1	1	3	2	1
CO5	3	3	2	3	1	1	1	1	3	2	1
CO1	3	2	1	3	3	1	1	1	3	2	2

List of Experiments:-

Expt. No. **Title of Experiment**

1. .Verification of Kirchhoff's Laws
2. Verification of Superposition Theorem
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Verification of Maximum Power Transfer Theorem
6. Verification of Reciprocity Theorem

7. Determination of transient response of RL & RC series circuits
8. To study Resonance in RLC series Circuit.
9. To study Resonance in parallel RLC Circuit.
10. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values
11. To calculate and verify ‘Z’ Parameters of a Two-Port Network.
12. To calculate and verify 'Y' parameters of Two-Port Network.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25AE407L	Electrical Machine – II Lab	01

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 02 per week	Continuous Assessment: 50 Marks Mid-Semester Exam: End Semester Exam: 50 Marks

Course Objectives:-

1	To determine the voltage regulation of alternators using direct loading and indirect methods (Synchronous Impedance and ZPF).
2	To understand the operational characteristics of Synchronous Motors through the plotting of V-curves and Inverted V-curves.
3	To perform synchronization of alternators with the grid using the three-lamp method or synchroscope.
4	To evaluate the performance of Induction Motors through No-load, Blocked-rotor and Brake tests.
5	To explore speed control techniques and starting methods for three-phase and single-phase induction motors.

Course Outcomes:-

CO1	Predict the voltage regulation of a 3-phase alternator by conducting various experimental tests.
CO2	Analyze the effect of excitation on the power factor and armature current of a synchronous motor.
CO3	Demonstrate the conditions and procedure for synchronizing alternators safely to a common bus-bar.
CO4	Determine the equivalent circuit parameters and efficiency of induction motors from experimental data.
CO5	Evaluate different starting and speed control methods for induction motors for specific industrial loads.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	3	1	1	1	1	3	2	1
CO2	3	2	1	3	1	1	1	1	3	2	1
CO3	3	3	2	3	2	2	1	1	3	2	2
CO4	3	3	2	3	1	1	1	1	3	2	1
CO5	3	3	3	3	2	2	1	1	3	2	2
CO1	3	3	1	3	1	1	1	1	3	2	1

List of Experiments:-

Expt. No.	Title of Experiment
1	To carry out load test on a three phase alternator to find its regulation.
2	To find regulation of three phase alternator by synchronous impedance method.
3	To plot V curve of three phase synchronous motor.
4	Slip-test on synchronous machine.
5	Zero power factor test on 3 phase Alternator.

6 To study Synchronizing of 3Ø alternators.

7 No load & blocked rotor test on Single-phase induction motor.

8 Measurement of slip of a three-phase induction motor by using Tachometer.

9 Brake test on three-phase induction motor.

10 To study Induction motor starters.

11 To control the speed of slip ring Induction motor by rotor resistance method.

12 Study of single-phase induction motors.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VSE408LA	**Analog and Digital Electronics Lab**	**1**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: End Semester Exam: 50 Marks

Course Objectives:-

1	To investigate the input-output characteristics of BJTs and the frequency response of amplifiers to understand signal processing fundamentals.
2	To provide hands-on experience in configuring Operational Amplifiers for various mathematical and signal conditioning operations.
3	To verify the functional behavior of Basic, Universal, and Derived logic gates as the building blocks of digital systems.
4	To design, implement, and troubleshoot complex Combinational Circuits such as adders, multiplexers, and code converters.
5	To explore the timing and state-based behavior of Flip-Flops and design synchronous counters for real-world timing applications.

Course Outcomes:-

CO1	Characterize BJT configurations and RC-coupled amplifiers by measuring gain, bandwidth, and input-output parameters.
CO2	Configure and test Operational Amplifiers in inverting and non-inverting modes to validate theoretical closed-loop gain.
CO3	Verify the truth tables of combinational and sequential logic circuits using integrated circuits (ICs).
CO4	Design and implement functional digital modules like multi-bit counters, multiplexers, and code converters.
CO5	Demonstrate proficiency in using electronic instruments (CRO, Multimeters) and preparing structured technical reports.

Mapping of Course Outcome with Program Outcomes

Course Outcome	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	2	2	1	1	1	2	1	1
CO2	3	2	2	2	2	1	1	1	2	1	1
CO3	3	2	1	2	1	1	1	1	2	1	1
CO4	3	3	3	2	3	1	1	1	3	2	2
CO5	1	1	1	2	1	2	2	3	3	3	2

List of Practical's to be performed

(Atleast 08 experiments should be performed from the following list)

1. To plot input characteristics and output characteristics of common emitter configuration.
2. To plot frequency response of RC coupled and transformer coupled amplifier.
3. To measurement of OP-AMP parameter.
4. To verify the operation of op-amp in inverting and non-inverting mode on AC input.
5. Verify truth table of following basic and derived gates:
   a) AND, OR, AND
   b) Ex-OR, NAND, NOR
6. Verification of truth table of flip-flop.
7. Design and implementation of 3-bit synchronous up/down counter.
8. Design and implementation of half and full adder using logic gates.
9. Design and implementation of multiplexer and de-multiplexer and study of IC 74150 and IC 74154.
10. Design and implementation of code converters:
    a) Binary to Gray code converter
    b) BCD to Excess-3

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VSE408LB	**Signals and System Lab**	**01**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To develop the ability to generate and manipulate various continuous and discrete-time signals using computational tools.
2	To investigate the fundamental properties of systems, such as linearity, time-invariance, stability, and causality through experimental verification.
3	To apply Fourier, Laplace, and Z-transforms to analyze signals and systems in both the frequency and complex s/z domains.
4	To verify the Sampling Theorem and understand the practical implications of aliasing and signal synthesis.
5	To introduce the concepts of Gaussian noise and use correlation techniques for signal recovery and noise removal.

Course Outcomes:-

CO1	Perform basic mathematical operations on matrices and generate various CT/DT signals to understand their symmetry and periodic nature.
CO2	Evaluate the impulse, step, and sinusoidal responses of LTI systems while verifying their stability and physical realizability.
CO3	Compute and interpret the magnitude and phase spectra using Fourier Transforms and observe the Gibbs Phenomenon in signal reconstruction.
CO4	Synthesize waveforms using Laplace transforms and determine system stability by locating poles and zeros in the S-plane and Z-plane.
CO5	Analyze Gaussian noise characteristics and implement correlation-based algorithms to recover signals from noisy environments.

Mapping of Course Outcome with Program Outcomes

Course Outcome	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1	2	3	–	–	–	1	1	1
CO2	3	3	2	3	3	1	–	–	1	1	2
CO3	3	3	2	3	3	1	1	–	1	1	2
CO4	3	3	3	3	3	1	1	–	1	1	2
CO5	3	3	3	3	3	2	2	1	2	2	3

List of Practical's to be performed

Exp. No.	Title of the Experiment
1.	Basic Operations on Matrices (Addition, Multiplication, Transpose, Inverse).
2.	Operations on Signals and Sequences (Shifting, Folding, Scaling).
3.	Finding Even and Odd parts of a Continuous-Time Signal.
4.	Finding Even and Odd parts of a Discrete-Time Signal (Sequence).
5.	Convolution of Two Sequences (Linear Convolution).
6.	Auto-Correlation & Cross-Correlation between Signals.
7.	Verification of Linearity Property of a given System.
8.	Verification of Time-Invariance Property of a given System.
9.	Gibbs Phenomenon: Observation of overshoot in Fourier series reconstruction.
10.	Wave Synthesis using Laplace Transform.
11.	S-Plane Analysis: Finding and Locating Zeros and Poles in the s-plane.
12.	Z-Plane Analysis: Finding and Locating Zeros and Poles in the z-plane.
13.	Sampling Theorem Verification: Observation of aliasing and reconstruction.
14.	Signal Recovery: Removal of noise using Auto-correlation/Cross-correlation in a corrupted signal.

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VSE408LC	**Embedded System Lab**	**01**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To familiarize students with the ARM processor architecture and its evaluation boards.
2	To understand the building blocks of an embedded system, including memory, I/O, and specialized peripherals.
3	To learn the concept of memory mapping and interfacing external EPROM/Flash memory.
4	To develop proficiency in writing C/Assembly programs to interface sensors, actuators, and displays.
5	To analyze the performance of hardware interrupts and their role in real-time responsiveness.

Course Outcomes:-

CO1	Develop and debug embedded C programs specifically for ARM-based architectures.
CO2	Execute memory-related operations and interface external memory units with the processor.
CO3	Interface and calibrate Analog-to-Digital (ADC) and Digital-to-Analog (DAC) converters for signal processing.
CO4	Analyze the latency and performance characteristics of interrupts in ARM and FPGA environments.
CO5	Design integrated solutions by interfacing keyboards, LCDs, stepper motors, and Zigbee wireless modules.

Mapping of Course Outcome with Program Outcomes

Course Outcome	**Program Outcomes**										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	3	1	3	1	1	1	2	1	2
CO2	3	3	2	1	2	1	1	1	2	1	1
CO3	3	2	3	2	2	1	1	1	2	1	1
CO4	3	3	2	3	2	1	1	1	2	1	1
CO5	3	2	3	2	3	2	2	3	3	2	2

List of Practical's to be performed

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and 7 segment display.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Interrupt performance characteristics of ARM and FPGA.
8. Flashing of LEDS.
9. Interfacing stepper motor and temperature sensor.
10. Implementing zig-bee protocol with ARM

Students are required to complete at least **eight experiments** throughout the semester.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VSE408LD	**Electromagnetic Engineering**	**01**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To visualize and calculate Electric Field Intensity and Flux Density for various charge distributions.
2	To experimentally or computationally analyze Field Transitions across different media interfaces (conductors/dielectrics).
3	To study the mechanical forces and magnetic fields generated by moving charges and current-carrying conductors.
4	To verify Maxwell's Equations in time-varying environments and observe wave propagation.
5	To measure and plot the Radiation Patterns of different antenna types and understand energy capture.

Course Outcomes: -

CO1	Apply vector calculus and coordinate systems to model and solve physical electromagnetic problems in a lab environment.
CO2	Measure and Plot electric and magnetic field distributions for point, line, and surface configurations.
CO3	Analyze the capacitance and boundary conditions for various dielectric and conducting geometries.
CO4	Validate the laws of Magnetostatics (Biot-Savart & Ampere) through experimental measurement of flux density.
CO5	Design and Characterize antenna systems by measuring parameters like gain, directivity, and radiation resistance.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	2	2	1	1	1	2	1	1
CO2	3	3	2	3	2	1	1	1	2	1	1
CO3	3	2	2	2	1	1	1	1	2	1	1
C04	3	3	2	3	2	1	1	1	2	1	1
C05	3	3	3	3	3	2	2	2	3	2	2

NOTE :- At least <u>05 assignments</u> should be given to students depending on syllabus.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25EVS409	**Workshop**	**01**

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 2 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: 50 Marks

Course Objectives:-

1	To familiarize students with standard electrical tools, symbols, and safety practices.
2	To provide hands-on experience in various domestic wiring systems and lighting circuits.
3	To explain the internal circuitry and working of modern power electronics like SMPS and UPS.
4	To demonstrate the construction and operating principles of various analog measuring instruments.
5	To emphasize the importance of protection devices (Fuses, MCBs) and electrical earthing for safety.

Course Outcomes: -

CO1	Identify and Select appropriate electrical tools, materials, and symbols for specific electrical installations.
CO2	Design and Execute standard wiring schemes, including staircase and domestic housing wiring (Conduit, Casing-Capping).
CO3	Analyze and Troubleshoot the internal circuits of SMPS, UPS, and Inverters used in home and industrial environments.
CO4	Distinguish between the working mechanisms of Moving Iron, Moving Coil, and Induction type meters for accurate measurement.
CO5	Implement safety protocols by installing protection devices like MCBs and executing proper earthing techniques.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	1	–	2	2	1	1	2	2	1
CO2	3	2	3	1	2	3	2	2	3	2	2
CO3	3	3	2	2	3	2	2	–	2	1	2
C04	3	2	1	2	2	1	–	–	1	1	1
C05	3	2	3	1	1	3	3	3	2	2	2

Course Contents: (Any four)

Sr. No.	Title
1.	Introduction of Tools, Electrical Materials, Symbols And Abbreviations.
2.	To Study Stair Case Wiring
3.	To Study House Wiring I.E., Batten, Cleat, Casing-Caping And Conduit Wirings
4.	To Study Fluorescent Tube Light.
5.	To Study Circuit of SMPS
6.	To Study Moving Iron, Moving Coil, Electrodynamic and Induction Type Meter.
7.	To Study Circuit And Working of UPS
8.	To Study Circuit And Working of Home Inverter
9.	To Study Fuses MCBs And Importance of Earthing.

SUBJECT CODE BTEE25HMS410	SUBJECT UNIVERSAL HUMAN VALUES – II	CREDITS 03

Teaching Scheme	Examination Scheme
Theory: 3 hr./week Tutorial : Practical:	Continuous Assessment: 20 Marks Mid-Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:-

1	To introduce the foundational principles of value education, focusing on self-exploration and the continuous pursuit of happiness and prosperity.
2	To develop an understanding of the human being as a harmonious coexistence of the self and the body, and to explore inner harmony.
3	To cultivate awareness of harmonious relationships within the family and society, based on trust, respect, and mutual understanding.
4	To promote ecological consciousness by understanding harmony in nature and recognizing the interconnectedness of all living and non-living systems.
5	To encourage ethical and professional responsibility through a holistic understanding and practical application of human values in both personal and professional life.

Course Outcomes:-

CO1	Explain the concept of value education and apply the process of self-exploration for personal development and overall well-being.
CO2	Distinguish between the needs of the self and the body, and practice self-regulation to maintain physical and mental health.
CO3	Demonstrate an understanding of harmonious relationships within the family and society, founded on trust, respect, and mutual fulfillment.
CO4	Analyze the principles of harmony in nature by recognizing coexistence and self-regulation among the four orders of nature.
CO5	Apply ethical principles in professional situations, demonstrating humanistic values and commitment to sustainable practices.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	1	1	1	3	3	2	2	1	2
CO2	1	1	1	1	1	3	3	2	2	1	2
CO3	1	1	1	1	1	3	3	2	2	1	2
CO4	1	1	1	1	1	3	3	2	2	1	2
CO5	1	1	1	1	1	3	3	2	2	1	2

Course Contents:

Unit – I: Introduction to Value Education **[08 Hours]**

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.

Unit – II: Harmony in the Human Being (Self) **[08 Hours]**

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.

Unit – III: Harmony in the Family and Society **[08 Hours]**

Family as the basic unit of human interaction, Values in human-human relationships: Trust, Respect, Affection, Care, Guidance, Gratitude, Justice and equality in society, Mutual happiness and mutual prosperity, Social responsibility of engineers.

Unit – IV: Harmony in the Nature and Existence **[08 Hours]**

Understanding nature as coexistence, Interconnectedness of human beings, society, and nature, Sustainable development, Ethical use of natural resources, Environmental responsibility of engineers, Role of technology in ecological balance.

Unit – V: Holistic Vision of Life and Profession **[08 Hours]**

Ethical responsibility in engineering profession, Value-based decision making, Professional ethics and social accountability, Holistic vision of life, Role of engineers in nation building, Case studies related to ethics and values.

TEXT BOOKS:

1. R. R. Gaur, R. Asthana, G. P. Bagaria, *A Foundation Course in Human Values and Professional Ethics*, Excel Books, New Delhi.
2. A. N. Tripathi, *Human Values*, New Age International Publishers.

References Books :-

1. M. K. Dixit, *Human Values and Professional Ethics*, Vikas Publishing House.
2. S. B. Lall & N. N. Tripathi, *Value Education*, Vikas Publishing House.
3. Subhash Sharma, *Ethics in Engineering*, Galgotia Publications.
4. AICTE Handbook on Universal Human Values.

NPTEL Course : Exploring Human Values: Visions of Happiness and Perfect Society, IIT Kanpur, by Prof. A. K. Sharma.

Link : https://nptel.ac.in/courses/109104068

SUBJECT CODE BTEE25HM411	Mini Project/Case Study/EDP Program/Startup Activity	CREDITS 02

Teaching Scheme	Examination Scheme
Theory: Tutorial : Practical: 4 hr./week	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam:

Course Objectives:-

1	Encourage experiential learning through hands-on projects and real-world case studies.
2	Develop entrepreneurial thinking and problem-solving skills.
3	Expose students to business planning, market analysis, and startup ecosystems.
4	Enhance teamwork, leadership, and communication through collaborative activities
5	Enable students to conceptualize, design, and present viable business or social solutions.

Course Outcomes:-

CO1	Demonstrate the ability to apply theoretical knowledge to practical challenges.
CO2	Analyze and present case studies with critical insights and strategic recommendations.
CO3	Design and execute mini projects with measurable outcomes.
CO4	Develop entrepreneurial ideas and articulate viable business models.
CO5	Exhibit teamwork, leadership, and presentation skills in project and startup contexts.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	2	1	1	2	2	2	2	2	2
CO2	1	2	2	1	1	2	2	2	2	2	2
CO3	1	2	2	1	1	2	2	2	2	2	2
CO4	1	2	2	1	1	2	2	2	2	2	2
CO5	1	2	2	1	1	2	2	2	2	2	2

Mini Project

- Project planning and execution
- Research, prototyping, and testing
- Evaluation and feedback mechanisms

Case Study

- Selecting and analyzing real-world cases
- Identifying challenges and proposing solutions
- Presentation and documentation techniques

Entrepreneurship Development Program (EDP)

- Business model canvas and lean startup principles
- Market research and feasibility analysis
- Funding, pitching, and scaling strategies

Startup Activity and Incubation

- Ideation and validation
- Building MVPs (Minimum Viable Products)
- Networking, mentorship, and incubation support

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VEC412	**Life of Shri Sant Gadge Baba**	**AU**

Teaching Scheme	Examination Scheme
Theory: 1 hr./week Tutorial : Practical:	Continuous Assessment: Mid-Semester Exam: - End Semester Exam:

Course Objectives:-

1	Understand the early life, background, and spiritual journey of Sant Gadge Baba.
2	Explore his contributions to social reform, sanitation, and upliftment of marginalized communities.
3	Analyze the philosophical and ethical principles guiding his actions and teachings.
4	Appreciate his role in promoting cleanliness, education, and humanitarian values.
5	Reflect on the relevance of his legacy in contemporary social and civic contexts.

Course Outcomes:-

CO1	Describe the life events and spiritual evolution of Sant Gadge Baba.
CO2	Identify his key contributions to social reform and public welfare.
CO3	Interpret the ethical and philosophical foundations of his teachings.
CO4	Evaluate the societal impact of his work and its historical significance.
CO5	Apply his values to current civic and educational initiatives.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	1	1	1	3	3	2	2	1	2
CO2	1	1	1	1	1	3	3	2	2	1	2
CO3	1	1	1	1	1	3	3	2	2	1	2
CO4	1	1	1	1	1	3	3	2	2	1	2
CO5	1	1	1	1	1	3	3	2	2	1	2

Unit – I: Early Life and Background **[02 Hours]**

- Birth and childhood in Shendgaon, Maharashtra
- Personal hardships and spiritual awakening
- Influence of Bhakti movement and saint traditions

Unit – II: Social Reform and Public Service **[02 Hours]**

- Village sanitation campaigns and shramdaan (voluntary labor)
- Promotion of education, dharmashalas, and public welfare institutions
- Advocacy for equality and justice

Unit – III: Philosophical and Ethical Teachings **[02 Hours]**

- Emphasis on service over rituals
- Ethical values: humility, compassion, and selflessness
- Kirtans and public discourses as tools for reform

Unit – IV: Legacy and Impact **[02 Hours]**

- Influence on leaders like Dr. B.R. Ambedkar
- Enduring inspiration for NGOs and civic movements
- Recognition by government and society

Unit – V: Contemporary Relevance **[02 Hours]**

- Cleanliness drives and Swachh Bharat parallels
- Moral education and civic responsibility
- Integration of Gadge Baba's values in modern curricula

Text Books / Reference Books

1. Sant Gadge Baba. (2015). Pune: Government of Maharashtra, Directorate of Cultural Affairs.
2. Sant Gadge Baba: Vyakti ani Karya. (2012). Nagpur: Maharashtra Rajya Sahitya ani Sanskruti Mandal.
3. Gadge Baba: Samajik Krantiche Praneta. (2016). Amravati: Sant Gadge Baba Amravati University Press.
4. Samaj Sudharak Sant Gadge Baba. (2014). Mumbai: Popular Prakashan.
5. Saints of Maharashtra. (2010). New Delhi: National Book Trust, India.
6. Bhakti Movement in India. (2009). New Delhi: Oxford University Press.

SUBJECT CODE	SUBJECT	CREDITS
BTEE25VEC413	**Moral & Ethical Development**	**01**

Teaching Scheme	Examination Scheme
Theory: 1 hr./week Tutorial : - Practical: -	Continuous Assessment: 50 Marks Mid-Semester Exam: - End Semester Exam: -

Course Objectives:-

1	Understand the basic concepts and significance of morality and ethics.
2	Explore major theories of moral and ethical development.
3	Examine the role of social, emotional, and cultural influences on moral behavior.
4	Apply ethical frameworks to analyze real-life dilemmas.
5	Promote moral reasoning and ethical awareness in personal and professional contexts.

Course Outcomes:-

CO1	Define key concepts in morality and ethics.
CO2	Describe and compare major theories of moral development.
CO3	Analyze factors influencing ethical behavior.
CO4	Evaluate ethical dilemmas using appropriate frameworks.
CO5	Demonstrate strategies to foster moral and ethical growth.

Mapping of Course Outcome with Program Outcomes

Course Outcome	Program Outcomes										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	1	1	1	1	3	3	2	2	1	2
CO2	1	1	1	1	1	3	3	2	2	1	2
CO3	1	1	1	1	1	3	3	2	2	1	2
CO4	1	1	1	1	1	3	3	2	2	1	2
CO5	1	1	1	1	1	3	3	2	2	1	2

Course Contents

Unit – I: Introduction to Morality and Ethics **[03 Hours]**

- Definitions and distinctions
- Importance in society and education
- Sources of moral values

Unit – II: Theories of Moral Development **[03 Hours]**

- Piaget, Kohlberg, Gilligan
- Social learning and moral reasoning

Unit – III: Influences on Moral Development **[03 Hours]**

- Role of family, peers, culture
- Emotional and cognitive factors

Unit – IV: Ethical Frameworks and Application **[03 Hours]**

- Utilitarianism, Deontology, Virtue Ethics
- Case studies and ethical decision-making

Unit – V: Contemporary Ethical Issues and Moral Education [03 Hours]

- Ethics in technology, environment, and society
- Strategies for moral education

Text Books / Reference books

1. Pande, G. (2023). Ethics, Integrity and Aptitude. New Delhi: Pearson Education.
2. Rachels, J., & Rachels, S. (2020). The Elements of Moral Philosophy (9th ed.). New York: McGraw-Hill.