Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Faculty of Science & Technology

Board of Studies

Electrical Engineering

TY B. Tech. Electrical Engineering

(Pattern: 2023)

(w.e.f. AY: 2025-26)

Syllabus: Third Year (TY B. Tech.) Electrical Engineering (2023 Pattern)
w.e.f. AY:2025-2026

SEMESTER-I

Course Code	NEP Category	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
EL23301	PCC	Electrical Machines- II	3	2		10	30	60		30		130	3	1		4
EL23302	PCC	Switchgear & Protection	3	2		10	30	60			30	130	3	1		4
EL23303	PEC	Programme Elective Course	3	2		10	30	60	30			130	3	1		4
MD23003	MDM	Multi-disciplinary minor	2	2		20	20	50	20			110	2	1		3
HS23301	VEC	Universal Human Values and Professional Ethics	2			10		60				70	2			2
	OE	(Open Electives)	2					50				50	2			2
EL23304	CEPFP	Community Engineering. Project/ Field Project		4		10			30		30	70	0	2		2
HS23302	AU	Constitution of India	1													
		Total	**16**	**12**	**0**	**70**	**110**	**340**	**80**	**30**	**60**	**690**	**15**	**6**	**0**	**21**
Programme Elective Course																
EL23303-A	PEC	Numerical Methods and Computer Programming	3	2		10	30	60	30			130	3	1		4
EL23303-B	PEC	Microcontroller and its Applications	3	2		10	30	60	30			130	3	1		4

SEMESTER-II

Course Code	NEP Category	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
			TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
EL23311	PCC	Control System Engineering	3	2		10	30	60			30	130	3	1		4
EL23312	PEC	Programme Elective Course	3			10	30	60			30	130	3	1		4
EL23313	PEC	Programme Elective Course	3	2		10	30	60			30	130	3	1		4
XX230XX	MDM	Multi-disciplinary minor	2	2		20	20	50	20			110	2	1		3
HS23311	VEC	Environment Studies	2			10		60				70	2			2
OE230XX	OE	(Open Electives)	2					50				50	2			2
EL23314	VSEC	Solar and EV Lab		4		10			30	30		70		2		2
HS23312	AU	Democracy, Election, and Governance	1													
		Total	**16**	**10**	**0**	**70**	**110**	**340**	**50**	**30**	**90**	**690**	**15**	**6**	**0**	**21**
Programme Elective Course																
EL23312-A	PEC	Power System Operation & Control	3	2		10	30	60			30	130	3	1		4
EL23312-B	PEC	Signals and Systems	3	2		10	30	60			30	130	3	1		4
EL23313-A	PEC	Electrical Installation, Design and Condition Based Maintenance	3	2		10	30	60			30	130	3	1		4
EL23313-B	PEC	Computer Aided Design of Electrical Machine	3	2		10	30	60			30	130	3	1		4

Mrs. J.S. Kulkarni
Dept. Autonomy Coordinator
Electrical Engg Dept.

Mrs. S. D. Rokade
Dept. Academic Coordinator
Electrical Engg Dept.

Mrs. P.N. Jaiswal
Head
Electrical Engg Dept.

Dr. C. B. Nayak
Dean Autonomy
VPKBIET, Baramati

Dr. S. M. Bhosle
Dean Academics
VPKBIET, Baramati

Dr. S. B. Lande
Principal
VPKBIET, Baramati

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
PUNE (MS.)

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology
Vidyanagari, Baramati-413133

Multidisciplinary Minor (MDM) Subjects			
AI23051	AI & Machine Learning	ET23053	Internet of Things
AI23052	Data Science	CE23051	Waste Management
AI23053	Generative AI	CE23052	Green Building & Smart Cities
CO23051	Cloud Computing	ME23051	Introduction to 3D Printing Technologies
CO23052	High Performance Computing	ME23052	Introduction to Robotics & Automation
CO23053	Computer Graphics & Gaming	EL23051	Solar Tech
IT23051	Cyber Security	EL23052	Industrial Automation
IT23052	Full Stack Development	GS23051	Nano Technology
ET23051	Embedded Systems	GS23052	Linear Algebra and Statistics
ET23052	Drone Technology		

Open Electives (OE) Subjects			
OE2301	Digital Marketing	OE2311	Biotechnology
OE2302	Professional Leadership	OE2312	International Relations
OE2303	Organizational Behavior	OE2313	Universal Human Values
OE2304	Industrial Management	OE2314	Education Technology
OE2305	Disaster Management	OE2315	Design Thinking
OE2306	Energy Economic & Management	OE2316	Financial Literacy for Bharat#
OE2307	Operation Research	OE2317	Sustainability & Climate Change
OE2308	Intellectual Property Rights	OE2318	Agriculture Technology
OE2309	Cyber Laws	OE2319	Architectural Technology
OE2310	Bioinformatics		

EL23301: Electrical Machines-II		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Course Activity: 10 Marks** **Examination Scheme:** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Practical Exam: 30 Marks**

Prerequisite Courses:

- Magnetic circuits, Force on current carrying conductor placed in magnetic field, Fleming Right hand & Left-hand rule.
- Working principle and construction DC Machines, transformer & 3-ph induction motor
- Phasor diagram and equivalent circuit of a single-phase transformer.

Course Objectives:

- Learn the construction and working principle ofthree-phase synchronous machines and 1-ph induction motors.
- Calculate voltage regulation of Alternator by different methods
- Study the applications of different machines in industrial, commercial, & social sectors.
- Determine the performance indices of AC series & single-phase motors by experimentation.

Course Outcomes

On completion of the course, learner will be able to

CO-1: Explain the construction and performance of three-phase synchronous machines.

CO-2: Analyze the performance of synchronous generators and evaluate voltage regulation using various methods.

CO-3: Demonstrate operation of synchronous motor at constant load and variable excitation (v curves & ∧ curves) & constant excitation and variable load.

CO-4: Describe the construction, performance and applications of AC Series Motor and Universal motor.

CO-5: Select appropriate special-purpose motors for different applications based on their construction, working principle, and characteristics.

CO-6: Explain the construction, performance and applications of single-phase induction motors with different self-starting methods.

Course Contents

Unit I: Three phase Synchronous generator (07Hrs)

Three phase Synchronous machines: Construction, rotating-armature type, salient-pole type and non-salient-pole type and their comparison, Excitation Methods. **Three phase Synchronous generator (cylindrical rotor type):** Principle of operation, Emf equation and winding factors (No derivation), rating of generator, Generator on no-load and on balanced load. Armature reaction and its effect under different load power factors. Voltage drop due to armature resistance, leakage flux and synchronous reactance, Per phase equivalent circuit and Phasor diagram, Power - power angle relation.

Three phase Synchronous generator (salient pole type): Armature reaction as per Blondel's two reaction theory for salient-pole machines, Direct-axis and quadrature-axis synchronous reactance's and their determination by slip test, Phasor diagram of Salient-pole generator and calculation of voltage regulation, Comparison between synchronous generator and induction generator, IEC standards of Synchronous machines.

Unit II: Voltage regulation and parallel operation of Three phase Synchronous generator (07 Hrs)

Performance of open circuit and short circuit test on synchronous generator, determination of voltage regulation by emf, mmf, and Potier triangle methods, Determination of voltage regulation by direct loading, Short circuit ratio, Parallel operation of 3-phase alternators: Necessity, conditions, Load sharing between two alternators in parallel (Descriptive treatment only),Process of synchronizing alternator with infinite bus-bar by lamp methods and by use of synchroscope (one dark & two equally bright method). Synchronizing current, power and torque (no numerical)

Unit III: Three phase synchronous motor (07 Hrs)

Principle of operation, Methods of starting, Equivalent circuit, significance of torque angle, Losses, efficiency and Power flow chart, Operation of 3-phase Synchronous motor with constant load and variable excitation ('V' Curves and 'inverted V' curves). Phenomenon of hunting and its remedies, Applications of 3-phase synchronous motors, Comparison of 3 phase synchronous motor with 3-phase induction motor.

Unit IV: A.C. series motor (07 Hrs)

Operation of D.C. series motor on a.c. supply, nature of torque developed, problems associated with AC. operation and remedies, Compensated series motor: Compensating

winding, conductibility and inductively compensated motor, Approximate phasor diagram, Use of compoles for improving commutation. Ratings and applications of Compensated Series motors, Universal motors: ratings, performance and applications, comparison of their performance on A.C. and D.C. supply.

Unit V: Special purpose motors **(07 Hrs)**

Special Purpose Motors : Construction, principle of working, characteristics ratings and applications of Brush less D.C. motors, Stepper motors (permanent magnet and variable reluctance type only), Permanent Magnet motor (A.C. & D.C.),Switched reluctance motor, Linear induction motor, Introduction to Energy Efficient three phase Induction Motor and Super conducting Generator.

Unit VI: Single phase induction motor **(07 Hrs)**

Construction of single phase induction motor, double field revolving theory, Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory,Tests to determine the parameters of equivalent circuit and calculation of performance characteristics of motor,Methods of self-starting,Types of single phase induction motors: Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run motor and permanent capacitor motor),Comparison of 1-phase induction motor with 3-phase induction motor

Books & Other Resources:

Text Books:

1. Nagrath and Kothari, Electrical Machines, 2nd Ed., Tata McGraw Hill.
2. S. K. Bhattacharya, Electrical Machines, Tata McGraw Hill.
3. P. S. Bimbhra, Electric Machinery, Khanna Publications.
4. B.R. Gupta and Vandana Singhal -Fundamentals of Electric Machines, New Age International (P) Ltd.
5. B. L Theraja –Electrical Technologyvol II , S. Chand publication.
6. V. K. Mehta and Rohit Mehta, Principles of Electrical Machines, S Chand Publication
7. Krishna Reddy –Electrical Machines vol.II and III, SCITECH publications.
8. Ashfaq Husain, Electrical Machines, Dhanpat Rai and Co.
9. M V Deshpande, Electrical Machines, Prentice Hall of India

Reference Books:

1. M.G. Say, Performance and Design of A.C. Machines (3rd Ed.), ELBS
2. J. B. Gupta - Theory and performance of Electrical Machines, S K Kataria Publications
3. Samarjit Ghosh, Electrical Machines, Pearson Publication.
4. E G Janardanan, Special Electrical Machines, Prentice Hall of India.
5. Suvarnsingh Kalsi Application of high Temperature super conductors to electric power equipments (Rotating Machines) Wiley publication.

Online Resources:

1) https://nptel.ac.in/courses/108/102/108102146/
   NPTEL course on Electrical machines By Prof. Bhuvaneshwari Department of Electrical Engineering IIT Delhi
2) https://nptel.ac.in/courses/108105131/
   NPTEL course on Electrical machines-II By Prof. Tapas kumar Bhattacharya Department of Electrical Engineering, IIT Kharagpur

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practical (Any 08 to be performed by the student)

1. Determination of Regulation of alternator by direct loading.
2. Determination of voltage regulation of cylindrical rotor alternator by following methods

a) EMF method b) MMF method.

3. Determination of regulation of cylindrical rotor alternator by Potier method.
4. Determination of regulation of salient pole alternator by slip test.
5. V and inverted V curve of synchronous motor at constant load.
6. Load test on three phase synchronous motor.
7. Load test on Single -phase induction motor.
8. Load test on Single-phase series motor.
9. No load and blocked-rotor test on a single-phase Capacitor-start induction motor and Determination of its equivalent circuit parameters.
10. Synchronization of three phase alternator by Synchroscope method.
11. Speed control of BLDC Motor
12. Parameter estimation of alternator using MATLAB.

Industrial Visit: Compulsory visit to Synchronous Machines / special purpose motors manufacturing company.

Note:

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following) :

1. Concept test
2. PowerPoint presentation

Mrs.V.V. Deokate
PAC Member 1

Mrs.P.N.Jaiswal
PAC Member 2

Mr.A.V.Golande
PAC Member 3

V.P.K.B.I.E.T. BARAMATI PUNE (MS.)

principles.

CO-5: Summarize different protection schemes to power transformers and induction motors.

CO-6: Explain different types of relays and Applying different types of protection schemes for transmission lines.

Course Contents

Unit I: Fundamentals of Protective relaying (07 Hrs)

Need for protective system, nature and causes of fault, types of faults, effects of faults, evolution of protective relaying, classification of relays, zones of protection, primary and backup protection, essential qualities of protective relaying. Trip circuit of circuit breaker. Various basic operating principles of directional over current, differential, distance, induction type relay, torque equation in induction type relay, current and time setting in induction relay, Numericals on TSM, PSM and operating time of relay.

Unit II: Fundamentals of Arc interruption (07 Hrs)

Ionization of gases, deionization, Electric arc formation, Current interruption in AC circuit breaker, high and low resistance principles, arc interruption theories, arc voltage, recovery voltage, derivation and definition of restriking voltage and RRRV, current chopping, interruption of capacitive current, resistance switching, current chopping and resistance switching.

Unit III: Circuit Breaker (07 Hrs)

Different ratings of circuit breaker (like rated voltage, rated current, rated frequency, rated breaking capacity symmetrical and unsymmetrical breaking, making capacity, rated interrupting duties, rated operating sequence, short time rating). Classification of high voltage circuit breakers, smart circuit breaker. Working and constructional features of ACB, Oil, SF6, VCB- advantages, disadvantages and applications. Auto reclosing, Testing of circuit breakers.

Unit IV: Static and Digital Relaying (07 Hrs)

Overview of Static relay, block diagram, operating principle, merits and demerits of static relay. Numerical Relays :- Introduction and block diagram of numerical relay, Sampling

EL23302: Switchgear and Protection		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering, Power System.

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To study the fundamental principles of protective relaying and its importance in electrical power systems.
2. To develop the ability of students with various techniques and devices used for arc interruption.
3. To study the operational principles, including the mechanical and electrical aspects of circuit breakers.
4. Interpret and analyze block diagrams associated with static and digital relays.
5. To study the different types of faults in the transformer, alternator and 3-phase induction motor.
6. Impart knowledge about transmission line protection schemes and the characteristics of different types of distance relays.

Course Outcomes

On completion of the course, learner will be able to

CO-1: Explain protective relaying concepts and how they are applied in electrical power systems.

CO-2: Elaborate various techniques used for arc interruption in electrical power systems.

CO-3: Analyze the operation of various types of circuit breakers, their performance and applications in electrical power systems.

CO-4: Describe static relay concepts, including their block diagram and operating

theorem, Anti-Aliasing Filter, Block diagram of PMU and its application. Wide area monitoring systems, emerging trends and innovations in protective relaying, future directions and research opportunities in static and digital relaying. Introduction of intelligent and smart relaying system protection, Relay coordination.

Unit V: Equipment Protection **(07 Hrs)**

I. Power transformer protection : Types of faults in transformer, percentage differential protection in transformers, incipient faults, protection against over fluxing, protection against inrush current.

II. 3 phase induction motor protection : Abnormal conditions and causes of failures in 3 phase induction motor protection, single phasing protection, overload protection, short circuit protection.

Unit VI: Transmission Line Protection **(07 Hrs)**

Introduction, over current protection for feeder using directional and non directional over current relays, introduction to distance protection, impedance relay, reactance relay, mho relay, quadrilateral relays, three stepped distance protection, effect of arc resistance, power swing on performance of distance relay, realization of distance relays(impedance, reactance, and mho relay) using numerical relaying algorithm (flowchart, block diagram).

Books & Other Resources:

Text Books:

1. Electrical Power Systems, C.L. Wadhwa, Newage Publishers.
2. Badri Ram, D. N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw Hill Publishing Co. Ltd.
3. Y. G. Paithankar, S. R. Bhide, "Fundamentals of Power System Protection", Prentice Hall of India.
4. Bhavesh Bhalja,R.P. Maheshwari, N.G. Chothani," Protection and Switchgear", Oxford University Press, 2011 Edition.
5. J.B.Gupta " Switchgear and Protection", S.K. Kataria and Sons.
6. Power system protection and switchgear by Oza, Nair, Mehta, Makwana.

Reference Books:

1. S. Rao, "Switchgear Protection and Power Systems", Khanna Publications.

2. J Lewis Blackburn, "Protective Relaying- Principles and Applications", Dekker Publications.
3. A.G. Phadke, J.S. Thorp,Computer relaying for Power System, Research Studies Press LTD, England. (John Willy and Sons Inc New York).
4. Mason C.R., "Art and Science of Protective Relaying", Wiley Eastern Limited.
5. Arun Ingole, "Switchgear and Protection", Pearson.

Online Resources :

1. Swayam course - Power system protection and switchgear.

https://archive.nptel.ac.in/courses/108/107/108107167.

2. Free certified course - Fundamentals-of-electrical-switchgear

https://alison.com/course/fundamentals-of-electrical-switchgear.

Industrial Visit :

Recommended industrial visit to switchgear training center/or relay manufacturing unit/or 220 kV substation/or sugar factory.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and

get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 08 to be performed by the student)

1. Study of switchgear/protective relay testing system.
2. To perform testing of fuse.
3. To perform testing of MCB.
4. To perform testing of MCCB.
5. To perform testing of contactor.
6. To perform testing of thermal overload relay.
7. To perform testing and plotting characteristics of IDMT type Induction over current relay.
8. To perform testing and plotting characteristics of digital over current relay.
9. Study of percentage differential protection of transformer (Merz Price Protection).
10. Study of bus-bar protection scheme.
11. To perform testing of three phase transmission line training system
12. Circuit breaker status indication from field input (V-lab).

Note :

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following) :

1. Study of datasheet (Circuit breaker/Relay)
2. Design of protection scheme for substation/ residential/ commercial.

Mr. R. S. Tarade
PAC Member 1

Mr. A. B. Akhade
PAC Member 2

Mr. D. S. Yeole
PAC Member 3

VPKBIET BARAMATI

EL23303-A: Numerical Methods and Computer Programming		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Term Work: 30 Marks**

Prerequisite Courses:

1. Engineering Mathematics.
2. Basics of Electrical Engineering and Electrical Circuit Analysis.
3. Programming and Problem solving.

Course Objectives:

1. To understand the need of computational techniques and analyse errors involved in the computation.
2. To study various numerical techniques for the solution of transcendental and polynomial equations.
3. To understand the Interpolation method of fitting the data points to represent the value of a function.
4. To study different numerical techniques for solving various kinds of equations, including differentiation and integration.
5. To understand various numerical techniques for Solution of Linear Simultaneous Equations.
6. To understand various numerical techniques for Solution of Ordinary Differential Equations (ODE).

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Explain types of errors in computation and their causes of occurrence.

CO-2: Evaluate roots of algebraic and transcendental equations using various numerical methods and develop algorithm for curve fitting.

CO-3: Apply numerical methods for various mathematical problems based on interpolation and develop algorithm.

CO-4: Evaluate numerical differentiation and integration problems using various numerical methods.

CO-5: Evaluate numerical problems and determine solutions of linear simulation equations.

CO-6: Apply numerical methods for various mathematical problems based on ordinary differential equations.

Course Contents

Unit I: Numerical Computations, Errors and Concept of root of equation (7 Hrs)

Basic principle of numerical computation and Engineering Mathematics. Floating point algebra with normalized floating point technique, Significant digits. Errors: Different types of errors, causes of occurrence and remedies to minimize them, Generalized error formula (Derivation and Numerical), Concept of roots of an equation. Descartes' rule of signs. Roots of Polynomial Equations using Birge-Vieta method.

Unit II: Solution of Transcendental, polynomial equation and Curve Fitting (6 Hrs)

Solution of Transcendental and polynomial equation using Bisection, Regula- Falsi, Newton-Raphson method for single variable and two variables. Curve fitting using least square approximation – First order and second order

Unit III: Interpolation (7 Hrs)

Forward, Backward, Central and Divided Difference operators, Introduction to interpolation.

A) Interpolation with equal Intervals - Newton's forward, backward interpolation formula (Derivations and numerical), Stirling's central difference formula (Only numerical).
B) Interpolation with unequal Intervals- Newton's divided difference formula and Lagrange's interpolation (Derivations and numerical).

Unit IV: Numerical Differentiation and Integration (7 Hrs)

A) Numerical Differentiation using Newton's forward and backward interpolation formula (Derivation and numerical).
B) Numerical Integration: Trapezoidal and Simpson's rules as special cases of Newton-Cote's quadrature technique for single integral. Numerical on double integrals using Trapezoidal, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.

Unit V: Solution of Linear Simultaneous Equations (7 Hrs)

Solution of linear simultaneous equation: Direct methods - Gauss elimination method, concept of pivoting – partial and complete. Gauss Jordan method, Iterative methods - Jacobi method and Gauss Seidel method. Matrix Inversion using Gauss Jordan method.

Unit VI: Solution of Ordinary Differential Equation (ODE) (6 Hrs)

Solution of First Order Ordinary Differential Equation (ODE) using Taylor's series method, Euler's method, Modified Euler's method (Derivation and numerical). Runge-Kutta fourth order method (Numerical).

Books & Other Resources:

Text Books:

1. M. K. Jain, S.R.K. Iyangar, R. K. Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Publications.
2. Dr. B. S. Grewal, "Numerical Methods in Engineering & Sciences", Khanna Publishers.
3. P. P. Gupta & G.S Malik, "Calculus of Finite Difference and Numerical Analysis", Krishna Prakashan Media Ltd, Meerut.
4. T. Veerarajan and T. Ramchandran, "Numerical Methods with Programs in C and C++", Tata McGraw Hill Publication.
5. S Arumugam, "Numerical Methods" Scitech Publication.

Reference Books:

1. J. B. Scarborough, "Numerical Mathematical Analysis", Oxford & IBH, New Delhi.
2. Steven Chapra, Raymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publication.
3. S.S. Sastry, "Introductory methods of Numerical Analysis", PHI Learning Private Ltd.
4. P. Thangaraj, "Computer oriented Numerical Methods", PHI Learning Private Ltd.
5. Yashwant Kanitkar, "Let us Python", pbp publications.

Guidelines for Laboratory - Term Work Assessment:

1. The distribution of weightage of term work marks should be informed to students before the start of the semester.
2. Term work assessment should be on a continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.

9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practicals (Any 08 to be performed by the student)

Develop computer program for following experiments using **Python language**

1. Find number of positive roots and negative roots in RLC circuit using Descarte's rule of sign.
2. Develop algorithm, draw flow charts and write a program to implement Birge Vieta method for finding roots of equations in RLC circuit.
3. Develop algorithm, draw flow charts and write a program to implement Bisection method for finding current in circuit using KCL/KVL.
4. Fit a curve for finding voltage across capacitor during charging using least square method.
5. Develop algorithm, draw flowchart and write a program to apply Newton's forward interpolation method for finding voltage across capacitor during charging.
6. Find current through first order circuit (RL series) using Simpson's $1/3^{rd}$ Rule.
7. Find current through first order circuit (RL series) using Simpson's $3/8^{th}$ Rule.
8. Apply Gauss Jacobi Method for solving a set of equations in an electrical network using KVL.
9. Implement 4^{th} order Runge Kutta method for solving ordinary differential equations in RC series circuits with DC source.
10. Apply Gauss Seidal Method for solving a set of linear simultaneous equations in 2 loop networks with DC source.
11. Apply Gauss Jordan Method for solving a set of linear simultaneous equations in 2 or 3 loop networks with DC source.
12. Apply Modified Euler's method for solving ordinary differential equations in RC series circuit with DC source.

Course Activities (Any ONE of the following):

For the assessment of Course Activity, a student must complete at least ONE activity out of the following:

1. Quiz based on numerical techniques.
2. Poster presentation on different algorithms.

Dr. H. M. Shaikh	Mr. D. M. Padulkar	Mr. R. V. Panchal
PAC member 1	PAC member 2	PAC member 3

EL23303-B: Microcontroller and its Applications		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Course Activity: 10 Marks** **Term-Work: 30 Marks**

Prerequisite Courses: Number system, Digital Electronics and Logic design, C programming language, Microprocessor Techniques.

Course Objectives:

The objectives of this course are

1. To study architectural details of PIC18FXXX microcontroller.
2. To study I/O ports and other IO peripherals, addressing modes and to develop ability to write an embedded C language programs for PIC18FXXX.
3. To study the concepts of timers, Special Hardware features of PIC18FXXX.
4. To study the concepts of timers, serial communication and interrupts of PIC 18FXXX.
5. To study applications of PIC18 through various interfacing devices like ADC, DAC, LCD, LED, etc.
6. To study real world applications interfacing PIC 18 Microcontroller.

Course Outcomes:

On completion of the course, learner will be able to

CO-1: Explain the architecture, features and memory organization of PIC18FXXX microcontroller.

CO-2: Summarize addressing modes and develop, debug program in embedded C language for various applications.

CO-3: Explain and develop programs of timers and Special Hardware applications of PIC18FXXX.

CO-4: Explain the interrupts handling and serial communication in PIC18FXXX and execute its programming.

CO-5: Explain and develop program of various applications interfacing with PIC18FXXX microcontroller.

CO-6: Design various real world applications interfacing PIC18FXXX microcontroller.

Course Contents

Unit 01: PIC Microcontroller Architecture (08 Hrs.)

Introduction: Introduction to microcontroller, Brief history of microcontrollers, Difference between microprocessor and microcontroller, Criteria for selection of microcontroller, **PIC18FXXX**: Features and architecture, comparison of PIC 18 series microcontrollers; PIC18F458/452 Pin out connection, Registers of PIC18F; **Program and data memory organization:** The Program Counter and Programmable ROM space in the PIC, File register and Access bank, Bank switching in PIC18.

Unit 02: Embedded C Programming of PIC microcontroller (07 Hrs.)

Addressing modes: Addressing modes with instruction example, Oscillator configurations, Reset operations, Brownout reset, Watchdog timer, Power down modes & Configuration registers, Embedded C concepts, Header and source files and pre-processor directives, Data types, data structures, Control loops, functions, bit operations. I/O port programming in C.

Unit 03: Special Hardware features and Timers Programming (06 Hrs.)

Various Timers in PIC 18, Timer 0,1,2 and 3 programming, CCP modes: Capture, Compare and PWM generation, Timers required for CCP Applications, Applications of CCP mode, Generation of waveform using Compare mode of CCP module. Period measurement of an unknown signal using Capture mode in CCP module, DC Motor speed control using PWM mode of CCP module

Unit 04: Interrupt and Serial port programming (06 Hrs.)

PIC Interrupts: Interrupt Vs Polling, IVT, Steps in executing interrupt, Sources of interrupts; Enabling and disabling interrupts, Interrupt registers, Priority of interrupts, Programming of: Timer using interrupts, External hardware interrupts, Serial communication interrupt. Basics of Serial communication protocols: Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.

Unit 05: Real world Interfacing of PIC Microcontroller I (07 Hrs.)

Port structure, Interfacing of Electromechanical Relays, LED, Keyboard using PIC Microcontroller, PIC ADC, Programming of ADC using interrupts, Interfacing DAC with PIC18F458, Using PIC microcontroller interfacing of LCD (16x2) in 4-bit mode.

Unit 06: Real world Interfacing of PIC Microcontroller II (06 Hrs.)

Microcontroller, PIC ADC, Programming of ADC using interrupts, Interfacing DAC with PIC18F458, Using PIC microcontroller interfacing of LCD (16x2) in 4-bit mode.

Unit 06: Real world Interfacing of PIC Microcontroller II (06 Hrs.)

Interfacing with Actuators (DC Motor, Stepper motor, Servomotor), Measurement of temperature and power using PIC microcontroller, Case study: Home protection, level and temperature monitoring.

Books & Other Resources:

Text Books:

1. PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18 by Muhammad Ali Mazidi, Rolind D. McKinley, Danny Causey, Pearson Education.
2. Fundamentals of Microcontrollers and Applications in Embedded Systems with PIC by Ramesh Gaonkar, Thomson and Delmar learning, First Edition.
3. Programming And Customizing the PIC Microcontroller by Myke Predko, TATA McGraw-Hill.
4. PIC microcontroller: An introduction to software and Hardware interfacing by HanWay-Huang Thomson Delmar Learning.
5. Microcontroller Theory and Applications with PIC18F, M.Rafiquzzaman, John Wiley and Sons

Reference Books:

1. Ibrahim, Dogan, "PIC Microcontroller Projects in C: Basic to Advanced", Newnes, 1st Edition, 2014, Boston.
2. Bates, John, "PIC Microcontrollers: An Introduction to Microelectronics", Butterworth Heinemann, 3rd Edition, 2011, Oxford.
3. PIC18F458 datasheet
4. MPLAB IDE user guides
5. MICROCHIP Technical Reference Manual of 18F4520 Embedded Design with PIC 18F452 Microcontroller by John B. Peatman, Prentice Hall

MOOC / NPTEL Courses:

1. NPTEL Course "Microcontroller and Applications"

Link of the Courses:

1. https://nptel.ac.in/courses/117/104/117104072/
2. https://nptel.ac.in/courses/108/105/108105102/

Guidelines for Laboratory - Term work Assessment:

1. The distribution of weightage of term work marks should be informed to students before the start of the semester.
2. Term work assessment should be on a continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Experiments (Any 8 experiments to be performed by the student)

1. Introduction to PIC 18F kit and introduction to MPLAB software.
2. Write an embedded C program to perform addition, subtraction and multiplication of two hex numbers.
3. Develop and Execute Programs on Time delay.
4. Develop and execute programs on Different Interrupt handling.

5. Develop and execute programs on Serial Communication.
6. Write an embedded C program to interface LEDs and switch with PIC18F458. Blink the LEDs when button is pressed.
7. Write an embedded C program to interface the LCD [16 X 2] with PIC18F458
8. Generation of square, positive ramp, negative ramp, triangular waveforms using DAC interface
9. Write an embedded C program to interface buzzer and relay with PIC18F458.
10. Write an embedded C program to interface DC motor with PIC 18F458 and control its speed using PWM.
11. Write an embedded C program to interface stepper motor with PIC 18F458.
12. Write an embedded C program to interface LM35 temperature sensor with PIC 18F458 and display temperature on it.

Note:

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following):

1. Study of various Data sheets and its Presentation.
2. Free PIC Microcontroller Tutorial - Introduction to PIC18F Microcontroller | Udemy

PAC Member 1
(Ms.S.D Rokade)

PAC Member 2
(Mrs.J.S Rangole)

PAC Member 3
(Mr.K.S Bhagwat)

VPKBIET BARAMATI
PUNE (MS.)

HS23301: Universal Human Values and Professional Ethics		
Teaching Scheme: **TH: 02 Hrs/Week**	**Credits:02**	**Examination Scheme:** **Course Activity: 10 Marks** **End-Semester Exam: 60 Marks**

Course Objectives:

This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education and professional ethics to the young enquiring minds.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Understand the concept of value education, self-exploration, happiness, and prosperity, and apply these principles for holistic personal development.

CO-2: Recognize the co-existence of the self and the body, differentiate their needs, and develop a balanced approach towards physical and mental well-being

CO-3: Analyze the importance of trust, respect, justice, and relationships in family and social interactions and apply these values to foster harmony in society

CO-4: Comprehend the interconnectedness of all living beings and the environment, and develop a responsible attitude towards sustainable living and ecological balance

CO-5: Apply ethical principles, human values, and professional ethics in their career, decision-making, and social responsibilities to contribute towards a value-based society.

Course Contents

Unit I: Introduction to Value Education (5 Hrs)

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human

Aspirations.

Unit II: Harmony in the Human Being **(5 Hrs)**

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 **(5 Hrs)**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Unit IV: Harmony in the Nature/Existence **(5 Hrs)**

Understanding Harmony in Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Coexistence at All Levels, The Holistic Perception of Harmony in Existence.

Unit V: Implications of the Holistic Understanding – a Look at Professional Ethics: **(6 Hrs)**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Books & Other Resources:

Text Book

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.
2. The Teachers Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana.
3. Professional Ethics and Human Values, Premvir Kapoor, Khanna Book Publishing.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Rediscovering India - by Dharampal.
9. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
10. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972
11. Limits to Growth – Club of Rome's report, Universe Books.
12. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
13. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
14. A N Tripathy, 2003, Human Values, New Age International Publishers.
15. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press.
16. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
17. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
18. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources)

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Ms. Rohini Naik	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati

VPKBIET BARAMATI Affiliated to S.P.P.U. Pune PUNE (MS.)

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology,
Vidyanagari, Baramati-413133

EL23304: Community Engineering Project/Field Project		
Teaching Scheme	**Credits**	**Examination Scheme**
PR: 04 Hrs/Week	Practical: 02	Activity: 10 Marks TW: 30 Marks OR: 30 Marks

Prerequisites: Basic knowledge of Electrical Systems, along with problem-solving and project management skills relevant to community-based engineering solutions

Objectives:

1. Utilize electrical engineering principles to solve real-world community problems through field projects.
2. Gain practical exposure to electrical systems, power distribution, renewable energy, and automation in a real-world setting.
3. Develop engineering solutions that contribute to sustainable community development, such as rural electrification, energy conservation, or smart grid implementation.
4. Enhance problem-solving skills by analyzing electrical infrastructure, conducting energy audits, and proposing improvements.
5. Work effectively in multidisciplinary teams to design, develop, and implement electrical engineering solutions.
6. Understand industry standards, electrical safety regulations, and ethical considerations in engineering projects.
7. Encourage students to propose innovative solutions using modern electrical technologies.
8. Improve technical report writing, presentation skills, and project documentation for professional and academic purposes.

Course Outcomes:

1. Analyze community-based electrical engineering challenges and propose feasible technical solutions.
2. Apply electrical engineering concepts to design and implement practical field-based projects.
3. Evaluate the sustainability and impact of electrical engineering solutions on society and the environment.
4. Demonstrate teamwork, leadership, and project management skills in the execution of field projects.
5. Adhere to professional ethics, electrical safety standards, and regulatory compliance in engineering projects.
6. Develop effective communication skills through technical presentations, reports, and community engagement activities.

Procedure: A group of 4-5 students will be assigned to a faculty member called a mentor. Based on the engineering knowledge of a group and societal and industry problems, the mentor has to guide a group to identify project problems and plan the work schedule. Here, the expected outcomes of the project must be noted. The complete work-plan should be

divided in the form of the individual tasks to be accomplished with targets. Weekly review of the completed task should be taken and further guidelines are to be given to a group. The final activity will be presenting the work completed and submitting the report. A group should be promoted to participate in a competition or write a paper.

Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content, and the structure of the activity. It may have

- A few hands-on activities that may or may not be multidisciplinary.
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize, and present their learning.
- Activities on solving real-life problems, investigation /study, and writing reports of in-depth study, fieldwork.

Activity (10 Marks): "Identifying a Problem Statement for Community/Field Project through Survey & Literature Review"

Objective:

Students will conduct a survey and literature review to identify a relevant problem for a community or field project. This exercise emphasizes practical research skills and helps in formulating a problem statement for engineering solutions in real-world community settings.

1. **Community Survey – (4 Marks)**

- Design and conduct a short survey (3-5 questions) to identify a specific engineering problem faced by the local community (e.g., water access, energy efficiency, waste management, etc.).
- Interview at least 5-10 community members (either physically or via an online platform) to gather their feedback.
- Summarize the results to highlight the most pressing issue.

2. **Literature Review – (4 Marks)**

- Conduct a literature review to explore existing research, solutions, and technologies related to the identified issue.
- Find at least 2-3 studies, articles, or reports on similar problems and solutions implemented in other communities.
- Compare the results of the survey with findings from the literature to understand how the community's issue has been addressed elsewhere.

3. **Formulate a Problem Statement – (2 Marks)**

- Based on the survey and literature review, write a concise problem statement.

- The problem statement should clearly define the issue, its relevance to the community, and the need for a mechanical engineering solution.

Evaluation Criteria: (10 Marks)

- Effectiveness and relevance of the survey in identifying a community problem – 4 Marks
- Depth and quality of the literature review – 4 Marks
- Clarity and impact of the problem statement – 2 Marks

Guidelines for implementing Community Engineering Project/ Field Project:

Assessment Criteria for Term Work (TW) – 30 Marks

1. Problem Identification and Research (6 Marks)

3 Marks: Well-defined problem statement supported by survey data and literature review.
3 Marks: Effective research including community insights and background analysis.

2. Design and Concept Development (7 Marks)

3 Marks: Innovative and technically feasible solution addressing community needs.
2 Marks: Use of electrical design tools (MATLAB, PSCAD, ETAP, AUTOCAD, etc.) for concept visualization.
2 Marks: Practicality in terms of cost, material selection, and energy efficiency.

3. Prototyping and Testing (8 Marks)

4 Marks: Development of a functional, safe, and user-friendly prototype.
3 Marks: Testing methodology, performance evaluation, and necessary modifications.
1 Mark: Documentation of the prototyping process (diagrams, simulation results, and photos).

4. Implementation and Community Engagement (5 Marks)

3 Marks: Successful deployment of the project with community interaction, training, and feedback.
2 Marks: Solution modifications based on community input and real-world testing.

5. Documentation and Report Writing (4 Marks)

3 Marks: Comprehensive, well-structured project report.
1 Mark: Proper referencing and citation of sources.

6. Presentation and Communication (5 Marks)

3 Marks: Clear, engaging presentation demonstrating the project's impact.
2 Marks: Effective visual aids (circuit diagrams, graphs, or multimedia) and ability to address queries confidently.

Assessment Criteria for Oral Examination (OR) – 30 Marks

1. Presentation Structure (10 Marks)

5 Marks: Logical flow from problem identification to solution deployment.
5 Marks: Well-organized content, smooth transition through key technical aspects.

2. Technical Understanding (8 Marks)

4 Marks: Demonstrates strong knowledge of electrical engineering concepts used in the project.
4 Marks: Effective problem-solving approach with engineering justifications.

3. Design & Prototyping (6 Marks)

3 Marks: Clear explanation of the design process, materials, and engineering tools used.
3 Marks: Functional explanation of the prototype with testing results.

4. Community Engagement (4 Marks)

2 Marks: Discussion on how community feedback was integrated into the solution.
2 Marks: Explanation of the social, economic, or environmental impact.

5. Response to Questions (2 Marks)

2 Marks: Confidence, accuracy, and clarity in answering queries.

Mr. D. S. Yeole	Dr. H. M. Shaikh	Mr. P. D. Upadhye
PAC Member 1	PAC Member 2	PAC Member 3

VPKBIET BARAMATI

HS23302: Constitution of India		
Teaching Scheme: **TH: 01 Hrs/Week**	**Audit Course**	**Examination Scheme:** **Nil**

Course Objectives:

The primary objectives of this course are to:

1. Familiarize students with the salient features, structure, and significance of the Constitution, including the principles enshrined in the Preamble.
2. Provide an understanding of fundamental rights and duties, their scope, significance, and role in ensuring justice, equality, and freedom in a democratic society
3. Explain the concept of Directive Principles of State Policy (DPSP) and their role in governance, emphasizing their interrelationship with Fundamental Rights.
4. Analyze emergency provisions and constitutional amendments, discussing their implications on Indian democracy and governance.
5. Encourage a comparative understanding of the Indian Constitution with other constitutions worldwide, fostering awareness of global governance models.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Describe the salient features and basic structure doctrine of the Constitution and Interpret the values enshrined in the Preamble.

CO-2: Comprehend Fundamental Rights and Duties of Indian Citizens.

CO-3: Analyze the Role of Directive Principles of State Policy (DPSP) in Governance.

Course Contents

Unit I: Introduction to the Constitution of India **(5 Hrs)**

Historical Perspective and Making of the Indian Constitution, Salient Features of the Constitution, Preamble and its Significance, Basic Structure of the Constitutional, Emergency Provisions in the Indian Constitution, Important Amendments to the Constitution.

Unit II: Fundamental Rights and Duties **(4 Hrs)**

Fundamental Rights: Meaning, Scope, and Significance, Right to Equality, Freedom, Protection from Exploitation, Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Fundamental Duties of Indian Citizens.

Unit III: Directive Principles and Governance **(4 Hrs)**

Directive Principles of State Policy: Meaning and Purpose, Relationship between Fundamental Rights and Directive Principles, Role of Directive Principles in Policy Formulation, Comparison with Other Constitutions.

Books & Other Resources:

Reference Books:

1. M. Laxmikanth, Indian Polity, McGraw Hill Education, 6th Edition, 2020.
2. D.D. Basu, Introduction to the Constitution of India, LexisNexis, 25th Edition, 2021.
3. Subhash Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust, 2019.
4. J.N. Pandey, The Constitutional Law of India, Central Law Agency, 2020.
5. Bare Act, Constitution of India, Government of India Publications.

Evaluation and Assessment

Since this is an audit course, there is a mandatory internal evaluation which can be based on the following:

- **Assignments & Reports** – Writing about a constitutional provision or case study.
- **Quiz/MCQs** – To test basic understanding of the Constitution.
- **Group Discussion/Presentation** – On relevant topics like Fundamental Rights or Constitutional Amendments.

Dr. A. B. Patil	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

VPKBIET BARAMATI

EL23311: Control System Engineering		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral: 30 Marks**

Prerequisite Courses: Applied Mathematics, Electrical Circuit analysis

Course Objectives: The course aims:

1. To understand basic concepts of the classical control theory.
2. To model physical systems mathematically
3. To analyse behaviour of system in time domain.
4. To study and analyse Stability Analysis techniques.
5. To analyse behaviour of system in frequency domain.
6. To understand concepts of State Space Analysis

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Compare open loop and close loop control system and study the classification of control system.

CO-2: Construct mathematical model of Electrical and Mechanical system using differential equations and transfer function and develop analogy between Electrical and Mechanical systems.

CO-3: Determine time response of systems for a given input and perform analysis of first and second order systems using time domain specifications.

CO-4: Analyze closed loop stability of system in s-plane using Routh Hurwitz stability criteria and root locus.

CO-5: Analyze the systems in frequency domain and assess stability using Bode plot and Nyquist plot .

CO-6: Evaluate the controllability and observability properties of the system.

Course Contents

Unit I: Introduction to Control System **(7 Hrs)**

Introduction to automation and automatic control, Introduction to control system block diagram, Importance of Control Systems. Components of control system, Classification of control systems, types of control system: feedback, tracking, regulator system, servomechanism,

feed forward system, Open loop control and closed loop control, SISO (Single Input Single Output) and MIMO (Multiple Input Multiple Output), Significance of actuators and sensors, Types of actuators (Electrical, Hydraulic, Pneumatic), Types of sensors (analog and digital)

Unit II: Control System Representation **(6 Hrs)**

Mathematical representation and Transfer function of mechanical, electrical, thermal, hydraulic system, Pole zero concepts, Block diagram representation and reduction, Signal flow graph.

Unit III: Time Domain Analysis **(7 Hrs)**

Standard Test Signals, Concept of transient and steady state response, Types and Order of system, Time response of first order, second order systems, Analysis of steady state error, Second Order time response specifications, Effect of parameter variation on open loop and closed loop system response, sensitivity, Effect of feedback on system response, stability and disturbance.

Unit IV: Stability Analysis **(7 Hrs)**

Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterion. Root Locus: Angle and magnitude condition, Basic properties of root locus. Construction of root locus, Stability analysis using root locus.

Unit V: Frequency Domain Analysis and Compensation Techniques **(8 Hrs)**

Concept of frequency domain behaviour, Bode Plot for analysing system in frequency domain. Frequency domain performance specifications. Correlation between time domain and frequency domain specification, Nyquist Plot, P, PI & PID control and its effect on overall system performance, Compensation Techniques: Lag, Lead, Lag-Lead compensator design based on bode plot.

Unit VI: State Space Approach **(7 Hrs)**

Representation of system in state space, converting transfer function model into state space model. Non uniqueness of state space model, Canonical representation, Eigenvalues, Solution of state equations, Concept of State feedback control, controllability, Observability, pole placement, Concept of the observer, Control system case study

Books & Other Resources:

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India.
2. M. Gopal, "Control Systems- Principle of Design", Fourth Edition, 2012, McGraw Hill.
3. I.J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 6th edition, 2017

Reference Books:

1. D'AzzoHoupis, Logakusha, Huelsoman, "Linear System Analysis", McGraw Hill.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Education Inc.
3. Norman S Nise, "Control System Engineering", John Wiley & Sons.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practicals (Any 8 to be performed by the student)

A) Minimum four experiments should be conducted

1. Experimental determination of DC servo motor parameters for mathematical modelling and transfer function
2. Experimental study of time response characteristics of R-L-C second order system. Validate the results using software simulation.
3. Experimental determination of frequency response of Lead compensator.
4. Experimental determination of frequency response of Lag compensator.
5. PID control of level/ Temperature/speed control system.
6. Experimental determination of transfer function of any one physical systems (AC Servomotor/Two Tank System/ Temperature control/ Level control)
7. Experimental analysis of D.C. Motor Position control system.

B) Minimum four experiments should be conducted (perform using software)

1. Stability analysis using a) Bode plot, b) Root locus and c) Nyquist plot.
2. Effect of P, PI and PID controllers on time response of second order system.
4. Effect of addition of pole-zero on root locus of the second order system.
5. Effect of addition of dominant and non-dominant poles on step response of second order system.
6. Obtain the State-space representation of the same system using Linear system analysis of MATLAB/ LabVIEW software.
7. Determine controllability and observability of the system using MATLAB/LabVIEW software.

Course Activity (Any one of the following):

1. Software Simulation
2. Quiz

PAC Member 1
Ms.S.D Rokade

PAC Member 2
Mr.H.M Shaikh

PAC Member 3
Mrs.P.N Jaiswal

EL23312-A: Power System Operation & Control		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Course Activity: 10 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering, Basics of Power System, Power System Analysis & Electrical Machines.

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To develop the ability to analyze and use various methods to improve stability of power systems.
2. To understand the need for control of reactive power and FACTs controllers with its evolution, principle of operation, circuit diagram and applications.
3. To illustrate the automatic frequency and voltage control strategies for single and two area case and analyze the effects, knowing the necessity of generation control.
4. To Understand the formulation of unit commitment and economic load dispatch and solve it using optimization techniques.
5. To study the various ways of energy control between interconnected utilities.
6. To provide an overview of the voltage stability define reliability aspects at all stages of the power system.

Course Outcomes

On completion of the course, learner will be able to

CO-1: Elaborate power system stability along with equal area criterion.

CO-2: Select appropriate FACTS devices for stable operation of the system.

CO-3: Explain the concept of automatic generation control.

CO-4: Analyze stability and optimal load dispatch using different techniques.

CO-5: Illustrate various ways of interchange of power between interconnected utilities.

CO-6: Explain the reliability and voltage stability of the system and suggest the methods to improve it.

Course Contents

Unit I: Power System Stability (07 Hrs)

Introduction to stability, dynamics of synchronous machine, swing equation, power angle equation and curve, types of power system stability (concepts of steady state, transient, dynamic stability), equal area criterion, applications of equal area criterion (sudden change in mechanical input, effect of clearing time on stability, critical clearing angle, short circuit at one end of line, short circuit away from line ends and reclosure), methods to improve steady state and transient stability, numerical based on equal area criteria.

Unit II: Reactive Power Management and FACTs Technology (07 Hrs)

Necessity of reactive power control, reactive power generation by a synchronous machine, effect of excitation, loading capability curve of a generator, compensation in power system (series and shunt compensation using capacitors and reactors), Problems with Series Compensation, synchronous condenser. Problems of AC transmission system, evolution of FACTs technology, principle of operation, circuit diagram and applications of SVC, TCSC, STATCOM and UPFC.

Unit III: Automatic Generation Control (AGC) (07 Hrs)

Introduction to the concept of AGC, complete block diagram representation of load frequency control of an isolated power system, steady state and dynamic response, control area concept, two-area load-frequency control, schematic and block diagram of the alternator voltage regulator scheme.

Unit IV: Economic Load Dispatch and Unit Commitment (07 Hrs)

A) Economic load dispatch: Introduction, revision of cost curve, incremental cost curve of thermal, method of Lagrange multiplier, exact coordinate equation (penalty factor), economic scheduling of thermal plant considering effect of transmission losses using Bmn coefficient. (Numerical on method of Lagrange multiplier, penalty factor, Bmn coefficient)

B) Unit commitment: Concept of unit commitment, constraints in unit commitment – spinning reserve, thermal and hydro constraints, methods of unit commitment – priority list and dynamic

programming, Numerical on priority list and dynamic programming method.

Unit V: Energy Control **(07 Hrs)**

Interchange of power between interconnected utilities (numerical), economic interchange evaluation, interchange evaluation with unit commitment, types of interchange, capacity and diversity interchange, energy banking, emergency power interchange, inadvertent power exchange, power pools.

Unit VI: Reliability & Voltage Stability of Power System **(07 Hrs)**

Definition of reliability of power system, hierarchical levels for reliability study, reliability evaluation of generation system, basic concepts related to voltage stability, classification of voltage stability, transmission system characteristics (PV curve), generator characteristics (QV curve), load characteristics, voltage collapse, voltage sag and swell.

Books & Other Resources:

Text Books:

1. Abhijit Chakrabarti, Sunita Halder, "Power System Analysis Operation and Control" 3rd Edition, 2010 Prentice Hall of India.
2. I. J. Nagrath, D. P. Kothari, "Modern Power System Analysis", 4th Edition, Tata McGraw Hill Publishing Co. Ltd.
3. P. S. R. Murthy, "Power System Operation & Control", Tata McGraw Hill Publishing Co. Ltd.
4. S. Sivangaraju & G. Sreenivasan,"Power System Operation and Control", 1st Edition, Pearson.
5. Narain G. Hingorani and Laszlo Gyugyi, "Understanding FACTs," IEEE Press.

Reference Books:

1. Prabha Kundur "Power system stability and control" Tata McGraw Hill.
2. Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation, and Control," Wiley India Edition.
3. Dr. K. Uma Rao, "Power System Operation and Control," Wiley India.
4. C. L. Wadhwa, "Electrical Power System", New Age International Publisher.

Online Resources:

1. NPTEL Course on Power System Dynamics, Control and Monitoring By Prof. Debapriya Das, IIT Kharagpur (https://onlinecourses.nptel.ac.in/noc25_ee66/preview)
2. NPTEL Course on Power System Engineering By Prof. Debapriya Das, IIT Kharagpur (https://onlinecourses.nptel.ac.in/noc25_ee67/preview)

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of practicals (Any 08 to be performed by the student)

1. To determine Steady state Stability of synchronous motor (performance).
2. To determine Steady state stability of medium transmission line (performance).
3. To apply Equal Area Criteria for Analysis of Stability Under Sudden Rise in Mechanical Power Input.
4. To apply Equal Area Criteria for Analysis of Stability Under Fault condition.
5. To plot swing curve by point by point method for transient stability Analysis.

6. To Study Lagrange Multiplier Technique for Economic Load Dispatch by MATLAB Software.
7. To study reactive power compensation using any device.
8. To develop dynamic programming methods for unit commitment by MATLAB software.
9. To study load frequency control using an approximate and exact model by MATLAB software.
10. To study the single area load frequency control with integral control.
11. To study the two area load frequency control.
12. To study the optimum loading of generators considering transmission losses (penalty factor).

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Industrial Visit: At least one industrial visit should be arranged to Load Dispatch Center / Power Station

Course Activity (Any one of the following):

1. **MCQ Test (GATE Preparation)**
2. **Technical Activity: NPTEL, Coursera, MATLAB Certification**
3. **Report submission on Case Study conducted**

Mr. Rohit S. Tarade	Mr. D. S. Yeole	Mr. Rohit S. Tarade	Mr. S. D. Shelar
Course Coordinator	PAC member 1	PAC member 2	PAC member 3

KBIET BARAMATI PUNE (MS.)

EL23312-B: Signals and Systems		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Knowledge of Engineering Mathematics, Analog and Digital Electronics, Circuit Analysis.

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To identify and classify different types of signals and systems.
2. To Analyze the impulse response and convolution properties of LTI systems
3. To apply Laplace Transform techniques for system analysis, including transfer function and pole-zero analysis.
4. To analyze discrete-time systems and assess stability using Z-transform.
5. To examine Fourier representations of signals and interpret frequency response for system analysis.
6. To explain sampling theorem, reconstruct signals from samples, and differentiate various modulation techniques.

Course Outcomes

On completion of the course, learner will be able to

CO-1: Identify and classify different types of signals and systems.

CO-2: Analyze LTI system properties and methods to examine impulse response, convolution, and system stability.

CO-3: Apply Laplace Transform techniques for system analysis, including transfer function and pole-zero analysis.

CO-4: Analyze discrete-time systems and assess stability using Z-transform

CO-5: Examine Fourier representations of signals and interpret frequency response for system analysis.

CO-6: Explain sampling theorem, reconstruct signals from samples, and differentiate various modulation techniques.

Course Contents

Unit 1: Introduction to Signals and Systems: **(07 Hrs)**

Definition and classification of signals: Continuous-time and discrete-time signals, periodic and aperiodic signals, even and odd signals, deterministic and random signals. Standard signals: Unit step, unit impulse, ramp, exponential, sinusoidal function. Properties of signals: Time shifting, scaling, and reversal, Classification of systems: Linear vs. nonlinear, time-invariant vs. time-variant, causal vs. non-causal, stable vs. unstable. Applications

Unit II: Linear Time-Invariant (LTI) Systems **(07 Hrs)**

Definition and properties of LTI systems, Impulse response and convolution integral for continuous-time systems, Convolution sum for discrete-time systems, Stability and causality conditions, Step response of LTI systems. Application: electric circuit analysis (RC, RL, and RLC circuits)

Unit III: Laplace Transform and System Analysis **(06 Hrs)**

Definition and properties of the Laplace transform, Region of Convergence (ROC), Inverse Laplace transform and application in system analysis, Transfer function and pole-zero analysis, Application: electrical network analysis.

Unit IV: Z-Transform and Discrete-Time System Analysis **(06 Hrs)**

Definition and properties of Z-transform, ROC and inverse Z-transform, Relationship between Laplace and Z-transform, Stability and causality in Z-domain, Application of Z-transform in discrete-time system analysis and control system design.

Unit V: Fourier Series and Fourier Transform **(07 Hrs)**

Fourier series representation of periodic signals (trigonometric & exponential forms), Fourier transform of continuous and discrete - time signals and its properties, Frequency response of LTI systems, Applications of Fourier transform in harmonics analysis of power system.

Unit VI: Sampling and Modulation Techniques **(06 Hrs)**

Sampling theorem and Nyquist criterion, Signal reconstruction from samples, Aliasing and

anti-aliasing filters, Basics of modulation: Amplitude modulation (AM), frequency modulation (FM), phase modulation (PM).

Books & Other Resources:

Text Books:

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
2. H. P. Psu, Schaum's Outline of "Signals and Systems", 3rd Edition (Schaum's Outlines).
3. V. Oppenheim Alan, S.Willsky Alan, Nawab S.Hamid, "Signal and System" 2nd Edition, XI'AN Jiaotong University Press.

Reference Books:

1. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford University Press, 2004.
2. Charles Phillips, "Signals , Systems and Transforms" , 3rd Edition, Pearson Education.
3. A. Anand Kumar, "Signal and Systems" 2nd edition, HPI Learning Pvt Ltd.

Online resources:

1. NPTEL Course on "Principles of Signals and Systems" By Prof. Aditya K. Jagannatham, IIT, Kanpur.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.

6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

List of Practical (Any 08 to be performed by the student)

Note: Perform experiments using MATLAB/Python programming.

1. To generate square wave, triangular, exponential, sinusoidal, step, impulse, and ramp function.
2. To verify time shifting, time scaling, reflection operations on square wave, triangular, exponential, sinusoidal, step, impulse, and ramp function.
3. To evaluate the convolution of finite discrete time signals and to verify the commutative, associative, distributive, and identity property.
4. To evaluate the convolution integral of a given signal.
5. To compute frequency response of LTI system from impulse response.
6. To compute the frequency response of the LTI system by difference equation.
7. To analyze system stability of the given function using Laplace Transform.
8. To obtain time-domain response by using inverse Laplace transform.
9. To find the Z-transform of discrete signals and assess system stability using pole-zero plots.
10. To find recursive system equations in the time domain by inverse Z-transform.
11. To demonstrate the effect of sampling and aliasing.
12. To calculate AM and FM modulation and demodulation for a given sequence.

Note :

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following):

1. Mini-Projects (Simulation) based on applications of Signals and Systems in Electrical Engineering, Power System.
2. Unit-wise Quiz.

Mr. Shivaji Raskar	Mr. Shashank Biradar	Dr. Rajveer Shastri
PAC Member 1	PAC Member 2	PAC Member 3

EL23313-A: Electrical Installation, Design and Condition Based Maintenance		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses:

Basic Electrical Engineering, Power System Engineering, Power System Analysis, Electrical Machines I and Electrical Machines II.

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To classify different types of distribution supply system and determine economics of distribution system.
2. To compare and classify various substations, bus-bars and earthing systems based on their function and application.
3. To identify and describe the maintenance strategies for transformer, induction motor, and alternator.
4. To evaluate the estimation and costing for internal wiring in residential and commercial installations.
5. To demonstrate various electrical installation testing procedures.
6. To apply electrical safety procedures.

Course Outcomes

On completion of the course, learner will be able to

CO-1: Classify different types of distribution supply system and determine economics of distribution system

CO-2: Compare and classify various substations, bus-bars and earthing systems based on their function and application

CO-3: Identify and describe the maintenance strategies for transformer, induction motor, and alternator

CO-4: Evaluate the estimation and costing for internal wiring in residential and commercial installations

CO-5: Demonstrate various electrical installation testing procedures

CO-6: Describe underground cable and apply electrical safety procedures

Course Contents

Unit I: Transmission & Distribution Economics **(07 Hrs)**

Economics of power transmission: Economic choice of conductor (Kelvin's law) (Derivation and Numerical). Classification of supply systems (i) DC, 2-wire system, (ii) Single phase two wire AC system, (iii) Three phase three wire AC supply system, iv) Three phase four wire AC supply system. Comparison between overhead and underground systems (For above mentioned systems) on the basis of volume requirement for conductor, AC Distribution System: Types of primary and secondary distribution systems, calculation of voltage drops in ac distributors (Uniform and Non Uniform Loading) (Numerical), Distribution Feeders: Design considerations of distribution feeders; radial and ring types of primary feeder's voltage levels, Energy losses in feeders.

Unit II: Substation and Earthing Systems **(07 Hrs)**

A) Substation: Classification of substations, Various equipment used in substation with their specifications, Bus bar arrangements in the substation: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

B) Earthing Systems: Necessity of Earthing, Equipment, Neutral, and Maintenance Free Earthing system, Methods of testing earth resistance, Different electrode configurations (Plate and Pipe electrode), Tolerable step and touch voltages, Steps involved in design of substation Earthing grid as per IEEE standard 80-2013.

Unit III: Maintenance and Condition Monitoring **(07 Hrs)**

A) Maintenance: Importance and necessity of maintenance, different maintenance strategies like breakdown maintenance, planned - preventive, predictive maintenance, Maintenance of transformer, Induction motor and Alternators, Use of AI and IoT in Predictive Maintenance Polarization index, Dielectric absorption ratio. Hot Line Maintenance - Meaning and advantages, special types of non-conducting Materials used for tools for hot line maintenance.

B) Condition Monitoring: Concept of condition monitoring of electrical equipment. Advance tools and techniques of condition monitoring: Thermography, Failure modes of transformer,

Condition monitoring of oil as per the IS/IEC standards, Filtration/reconditioning of insulating oil, Condition monitoring of transformer bushings, on load tap changer, dissolved gas analysis, degree of polymerization. Induction motor fault diagnostic methods – Vibration Signature Analysis, Motor Current Signature Analysis.

Unit IV: Estimation and Costing **(07 Hrs)**

Purpose of estimating and costing, qualities of good estimator, essential elements of estimating and costing, tender, guidelines for inviting tenders, quotation, price catalogue, labor rates, schedule of rates and estimating data (only theory), Introduction cable sizing, Estimation and conductor size calculations of internal wiring for Residential and Commercial (Numerical) installations and estimate for underground LT service lines.

Unit V: Testing of Electrical System **(07 Hrs)**

Understanding CAT Ratings & Using CAT rated Instrument, Electrical Installation Testing Procedures- Insulation resistance test between installation and earth, Insulation resistance test between conductors (use of GUARD Terminal in IR test & Application) (methods used for IR Testing) Testing of polarity, Testing of earth continuity paths (Applications of PAT Tester "Portable Appliance Tester" in commercial like hotels, hospital & Industry also) and Earth resistance test (methods for earth testing 3 Pole, 4 Pole)

Unit VI: Underground Cable and Electrical Safety **(07 Hrs)**

A) Underground Cables: Construction of Cables, Classification of cables, Capacitance of single core and three core cable, Dielectric stresses in single core cable, Grading of cables, Inter sheath grading, Capacitance grading.

B) Electrical Safety: Objectives of safety and security measures, Applications of AI in electrical safety, Approaches to prevent accidents, Various statutory regulations (Electricity supply regulations, Factory acts and Indian electricity rules of Central Electricity Authority (CEA), Electrical safety standards- IEEE 3007.3-2012, India Standardization IS-5216, IS-5571, IS-6665, Classification of hazardous area, Introduction to OSHA

Books & Other Resources:

Text Books:

1. B. R. Gupta- Power System Analysis and Design, 3rd edition, Wheelers publication
2. S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment,

Khanna publishers.

3. S. L. Uppal - Electrical Power - Khanna Publishers Delhi.
4. Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).
5. S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.
6. B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.
7. Hand book on Electrical Safety.

Reference Books:

1. P.S. Pabla –Electric Power Distribution, 5th edition, Tata McGraw Hill.
2. S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.
3. Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.
4. Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi
5. B.D. Arora-Electrical Wiring, Estimation and Costing, - New Heights, New Delhi.
6. M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.
7. S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication
8. Power Equipment Maintenance and Testing (Power Engineering Book 32) by Paul Gill

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram/circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.

6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 08 to be performed by the student)

1. Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.
2. Study of thermograph images and analysis based on these images.
3. Practice of earthing and Measurement of earth resistance of Campus premises by using 3 Pole/4 Pole method.
4. Draw a single line diagram of 132 kV or 220 kV or 400 kV substation by using Electrical AutoCAD software.
5. Design of earthing grid for 132/220 kV substation.
6. Design and estimation of light and power circuit of labs/industry.
7. Measurement of insulation resistance of motors and cables.
8. Precautions from electric shock and method of shock treatment.
9. Design and estimation of light and power circuit of residential wiring.
10. Estimation and costing for 11 kV feeders and substation
11. To conduct a market survey for collecting information related to electrical components, their specifications, and cost required for residential/commercial plan.
12. Trouble shooting of household equipment – Construction, working and troubleshooting of any two household Electrical equipment's (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults)
13. Design, Estimation and costing of earthing pit and earthing connection for computer lab, electrical machines lab.

Industrial Visit (if any): Visit to substation/installation/electrical maintenance site.

Note :

The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However the course coordinator needs to get approval by the Program

Assessment Committee and Chairman BOS/HOD well in time.

Course Activity (Any one of the following) :

1. Assembly of any household electrical equipment
2. Testing and troubleshooting of any household electrical equipment
3. Awareness about electrical earthing/safety/maintenance

Mr. D. S. Yeole	Mr. A. V. Golande	Mr. A. B. Akhade
PAC Member 1	PAC Member 2	PAC Member 3

VPKBIET BARAMATI PUNE (MS.)

EL23313-B: Computer Aided Design of Electrical Machine		
Teaching Scheme: **TH: 03 Hrs/Week** **PR: 02 Hrs/Week**	**Credits:04**	**Examination Scheme:** **Course Activity: 10 Marks** **In-Semester Exam: 30 Marks** **End-Semester Exam: 60 Marks** **Oral Exam: 30 Marks**

Prerequisite Courses: Basic electrical engineering, Fundamentals of electrical machines, Modelling of electrical machines.

Course Objectives:

1. To understand various cooling methods, constructional features and auxiliaries of three phase transformers.
2. To design a core and winding of a three phase transformer.
3. To determine performance parameters of a three phase transformer.
4. To design main dimensions of a three phase induction motor.
5. To design the stator and rotor of a three phase induction motor.
6. To determine performance parameters of a three phase induction motor.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Explain various cooling methods, constructional features and auxiliaries of three phase transformers.

CO-2: Design overall dimensions of the three phase transformer.

CO-3: Evaluate performance parameters of three phase transformers.

CO-4: Design main dimensions of a three phase induction motor.

CO-5: Design stator and rotor of a three phase induction motor.

CO-6: Evaluate the performance parameters of three phase induction motor

Course Contents

Unit I: Transformer Design: Part 1 **(7 Hrs)**

Modes of heat dissipation. Heating and cooling curves. Calculations of heating and cooling time constants. Methods of cooling a transformer. Types and constructional features of core and windings used in transformers. Transformer auxiliaries such as tap changer, pressure release valve, breather and conservator. Specifications of three phase transformers as per IS 2026 (Part I). Introduction to computer aided design.

Unit II: Transformer Design: Part 2 **(7 Hrs)**

Output equation with usual notations, design of main dimensions, core, yoke and windings of transformer. Methods of cooling and tank design with and without cooling tubes. Optimum design of transformer for minimum cost and loss.

Unit III: Performance Parameters of Transformer **(7 Hrs)**

Estimation of resistance and leakage reactance of transformer. Estimation of no-load current, losses, efficiency and regulation of transformers. Calculation of mechanical forces developed under short circuit conditions, measures to overcome this effect. Computer aided design of transformer, generalized flow chart for design of transformer.

Unit IV: Three phase Induction Motor Design: Part 1 **(7 Hrs)**

Specifications and constructional features. Types of ac windings. Specific electrical and magnetic loadings, ranges of specific loadings. Output equation with usual notations. Calculations for main dimensions, turns per phase and number of stator slots.

Unit V: Three phase Induction Motor Design: Part 2 **(7 Hrs)**

Suitable combinations of stator and rotor slots. Selection of length of air gap, factors affecting length of air gap, unbalanced magnetic pull. Design of rotor slots, size of bars and end rings for cage rotor. Conductor size, turns and area of rotor slots for wound rotor. Specifications of Induction motor.

Unit VI: Performance parameters of Three Phase Induction motor **(7 Hrs)**

Leakage flux and leakage reactance: Slot, tooth top, zig - zag, overhang. Leakage reactance calculation for three phase machines. MMF Calculation for air gap, stator teeth, stator core, rotor teeth and rotor core, effect of saturation, effects of ducts on calculations of magnetizing current, calculations of no-load current. Calculations of losses and efficiency. Computer aided design of induction motor, generalized flow chart for design of induction motor.

Books & Other Resources:

Text Books:

1. M. G. Say–Theory and Performance and Design of A.C. Machines,3rd Edition, ELBS London.
2. A.K. Sawhney–A Course in Electrical Machine Design, -Dhanpat Rai and sons New Delhi, 10th Edition.
3. K. G. Upadhyay- Design of Electrical Machines, New age publication,2004.
4. R. K. Agarwal–Principles of Electrical Machine Design, S. K. Kataria and sons,05th Edition,2014.
5. Indrajit Dasgupta –Design of Transformers–TMH.

Reference Books:

1. K. L. Narang, A TextBook of Electrical Engineering Drawings, Reprint Edition:1993/1994, Satya Prakashan, New Delhi.
2. A Shanmuga sundaram, G. Gangadharan, R. Palani, -Electrical Machine Design Data Book,3rd Edition, 3rd Reprint 1988- Wiley Eastern Ltd., - New Delhi
3. Vishnu Murti, "Computer Aided Design for Electrical Machines", B. S. Publications,2008.
4. Bharat Heavy Electricals Limited. Transformers-TMH.Handbook of International

Electrical Safety Practices, Princeton Energy Resources International, 2010.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Brief theory related to the concerned sheet.
2. Apparatus with their detailed specification as per IS code.
3. Design as per problem statement.
4. Reference tables used for design purposes.
5. Design parameters details in tabular form.
6. Few short questions related to design.
7. A3/A4 size sheet to be used for CAD drawing.

List of Practicals (Any 6 to be performed by the student)

Part A: (Compulsory practicals 1,2,3)

1. To explore the toolbar and basic functionalities of AutoCAD electrical software.
2. To draw the assembly of the three phase distribution transformer with a design report of various parts. (Sheet in AutoCAD Software).
3. To draw the layout of transformer windings with its design report. (Sheet in AutoCAD).

Part B: (Any 3 to be performed by the student)

1. To draw the assembly of a three phase induction motor with a design report of various parts. (Sheet in AutoCAD Software)
2. To draw the layout of single layer three phase winding with its design report. (Sheet in AutoCAD Software)
3. To draw the layout of double layer three phase winding with its design report. (Sheet in AutoCAD Software)
4. To draw the layout of three phase mush winding with its design report. (Sheet in AutoCAD Software)
5. To study Finite Element Analysis (FEA) for electrical machines includes:
    a. Schematic diagram (Diagram/FEA model/Layout)
    b. Current/Flux/Force/Heat distribution
    c. Analysis by variation of design parameters.

- Industrial Visit to manufacturing or repairing unit (any one of the following):
  1) Three phase transformer.
  2) Three phase induction motor.

Note: The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Course Activity: For the assessment of Course Activity, a student must complete at least ONE activity out of the followings:

1. Poster Preparation (Any ONE of the following)

A. To prepare a poster on different parts of Three phase power transformers of different manufacturing companies with their rating and specifications.
B. To prepare a poster on different parts of Three phase distribution transformers of different manufacturing companies with their rating and specifications.
C. To prepare a poster on different parts of Three phase slip ring induction motors of different manufacturing companies with their rating and specifications.
D. To prepare a poster on different parts of Three phase squirrel cage induction motors of different manufacturing companies with their rating and specifications.

2. Technical Quiz (based on every unit)

Mr.S.D. Shelar	Mrs. J. S. Kulkarni	Mr. S. D. Shelar	Mrs. V. V. Deokate
Course Coordinator	PAC member 1	PAC member 2	PAC member 3

VPKBIET BARAMATI PUNE (MS.)

HS23311: Environmental Studies		
Teaching Scheme: **TH: 02 Hrs/Week**	**Credits:02**	**Examination Scheme:** **Course Activity: 10 Marks** **End-Semester Exam: 60 Marks**

Prerequisites:

Fundamentals of the environment.

Course Objectives:

1. Understand the fundamental concepts of environmental science and its relevance to engineering.
2. Analyze the environmental impact of various engineering industries.
3. Learn about sustainable engineering practices, pollution control, and waste management.
4. Study environmental laws in India and global initiatives for environmental conservation.

Course Outcomes

On completion of the course, learner will be able to:

CO-1: Understand the components of the environment and types of energy resources.

CO-2: Analyze the impact of engineering industries on the environment.

CO-3: Learn sustainable engineering solutions for mitigating environmental damage.

CO-4: Aware of Indian and global initiatives for environmental protection.

Course Contents

Unit I: Introduction to Environmental Studies **(6 Hrs)**

Importance of Environmental Studies, Components of the Environment: Atmosphere, Hydrosphere, Lithosphere, and Biosphere, Ecosystems and Biodiversity: Types, Importance, and Conservation, Sustainable Development Goals (SDGs) and Role of Engineers in Sustainability, Renewable and Non-Renewable Resources, Water Resources: Overuse, Pollution, and Engineering Solutions, Energy Resources: Fossil Fuels, Nuclear Power, and Renewable Energy Alternatives, Land Resources: Soil Degradation, Deforestation, and Urbanization.

Unit II: Impact of Engineering Industries on Environment **(7 Hrs)**

Manufacturing & Automobile Industry: Air pollution, Carbon emissions, Waste disposal, Chemical & Pharmaceutical Industry: Water and soil contamination, Hazardous waste, Construction & Infrastructure: Land degradation, Dust pollution, Waste generation,

Electronics & IT Industry: E-waste, Energy consumption, Semiconductor waste, Power Generation (Thermal, Hydropower, Nuclear): Pollution, Waste heat, Radiation hazards, Causes and Effects of Climate Change, Global Warming and Greenhouse Effect.

Unit III: Engineering Solutions for Environmental Mitigation and Sustainable Practices (7 Hrs)

Carbon Capture and Storage (CCS), Eco-friendly Materials, Sustainable Design & Life Cycle Assessment (LCA), Energy-efficient Technologies & Smart Grids, Case Studies on Successful Pollution Reduction **Waste Management Strategies:** Solid Waste and Biomedical Waste Management, E-Waste: Sources, Impact, and Recycling, Hazardous Waste Handling and Treatment, Circular Economy and Zero-Waste Technologies **Sustainable Engineering Practices:** Renewable Energy Technologies (Solar, Wind, Biomass, Hydropower) Green Buildings and Sustainable Architecture, Electric Vehicles and Smart Transportation Systems, Sustainable Agriculture and Water Conservation Technologies.

Unit IV: Environmental Initiatives in India and Worldwide (6 Hrs)

National Initiatives: Swachh Bharat Abhiyan, Namami Gange, National Green Tribunal (NGT), Corporate Social Responsibility (CSR) & Environmental Compliance, Environmental Activism and the Role of NGOs, Environmental Laws and Policies in India, The Environmental Protection Act, 1986, Role of Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCB), International Environmental Agreements (Kyoto Protocol, Paris Agreement, COP Summits), Global Initiatives: UNEP, IPCC, World Bank Environmental Policies.

Books & Other Resources:

Text Books:

1. Benny Joseph, Environmental Studies, McGraw Hill Education, 3rd Edition, 2021. Anubha Kaushik & C.P. Kaushik, Environmental Studies, New Age International Publishers, 5th Edition, 2022.

Reference Books:

1. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2021.
2. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses, University Press, 3rd Edition, 2021.
3. Suresh K. Dhameja, Environmental Science and Engineering, S.K. Kataria & Sons, 2nd Edition, 2020.

Additional Reports & Resources:

- Government of India - Ministry of Environment, Forest & Climate Change (MoEFCC) Reports (Website)
- United Nations Environment Programme (UNEP) Reports (Website)
- IPCC Climate Change Reports (Website)

- Central Pollution Control Board (CPCB) Reports (Website)

List of Activities for reference:

Perform any two activities of the following.

1. **Ecosystem Study Report** – Visit a local park, water body, or forested area and document its ecosystem components (flora, fauna, food chains).
2. **Sustainability Case Study** – Choose one of the Sustainable Development Goals (SDGs) and prepare a report on its implementation in India.
3. **Renewable vs. Non-Renewable Resources** – Prepare a comparative chart listing sources, usage, and sustainability factors.
4. **Water Conservation Survey** – Conduct a survey in your neighborhood or campus to assess water consumption and suggest conservation strategies.
5. **Industrial Impact Assessment** – Select an engineering industry (automobile, chemical, IT, etc.) and analyze its environmental impact.
6. **Carbon Footprint Calculation** – Calculate the carbon footprint of your daily activities (electricity, transportation, food, etc.) and suggest ways to reduce it.
7. **Climate Change Awareness Video** – Create a short video (2–3 min) explaining global warming and its impact.
8. **Case Study on Pollution Control Failures** – Research a real-world incident of industrial pollution (e.g., Bhopal Gas Tragedy, Minamata Disease) and analyze the causes and consequences.
9. **Waste Management Audit** – Conduct a waste audit in your college or home, classify the waste generated, and propose a waste management plan.
10. **E-Waste Collection Drive** – Organize a drive to collect and safely dispose of e-waste in your locality. Submit a report on the amount collected and its disposal method.
11. **Renewable Energy Model** – Create a working or conceptual model of a solar panel, wind turbine, or biomass plant.
12. **Green Building Analysis** – Identify a green building in your city (or college) and analyze its energy-efficient features.
13. **Report on National Environmental Policies** – Summarize key environmental laws in India and their effectiveness.
14. **International Climate Agreements Presentation** – Prepare a presentation on major agreements like the Paris Agreement, Kyoto Protocol, and their impact on India.
15. **NGO/CSR Initiative Study** – Research an NGO or corporate social responsibility (CSR) initiative focused on environmental protection and prepare a report.
16. **Swachh Bharat Implementation Review** – Visit a local area, document cleanliness conditions, and suggest improvements under Swachh Bharat Abhiyan.

Evaluation Criteria (10 Marks Total)

- Depth of Analysis (3 Marks)
- Presentation & Clarity (3 Marks)
- Creativity & Practical Application (2 Marks)
- Timely Submission (2 Mark)

Mr. Abhijeet Gaikwad	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133

VPKBIET BARAMATI PUNE (MS.)

EL23314: Solar and EV Lab		
Teaching Scheme: **PR: 04 Hrs/Week**	**Credits:02**	**Examination Scheme:** **Course Activity: 10 Marks** **Practical Exam: 30 Marks** **Term-Work: 30 Marks**

Prerequisite Courses:

Knowledge of fundamentals of Solar Energy, basics of Electrical Engineering and Engineering Chemistry, Electric Mobility.

Course Objectives:

1. To understand the electrical characteristics of PV systems under varying light intensity, temperature, and configurations.
2. To design the solar photovoltaic system and simulate MPPT algorithms for optimized power extraction from PV panels.
3. To study speed control of electrical motor systems and battery performance under varying load and operational conditions.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Describe the performance of PV systems under varying light intensity, temperature, and configurations.

CO-2: Design the solar photovoltaic system and simulate MPPT algorithms for optimized power extraction from PV panels.

CO-3: Analyze speed control of electrical motor systems and battery performance under varying load and operational conditions.

Guidelines for Laboratory - Term work Assessment:

1. The distribution of weightage of term work marks should be informed to students before the start of the semester.
2. Term work assessment should be on a continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction:

1. DO's and DON'TS, along with precautions, are needed to be displayed at prominent locations in the laboratory.
2. Students should be informed about DO'S and DON'T and precautions before performing.

Guidelines for Students Lab Journal:

The Student's Lab Journal should contain following related to every experiment –

1. Theory related to the experiment.
2. Apparatus with their detailed specifications.
3. Connection diagram /circuit diagram.
4. Observation table/ simulation waveforms.
5. Sample calculations for one/two readings.
6. Result table.
7. Graph and Conclusions.
8. There should be continuous assessment for the TW.
9. Assessment must be based on understanding of theory, attentiveness during practical, understanding Session, how efficiently the student is able to make connections and get the results, and timely submission of journals.

LIST OF PRACTICALS (Any 12 experiments to be performed by the student)

1. To measure Voc and Isc of a Solar PV panel and obtain I-V and P-V characteristics of PV modules: for single PV module.
2. To obtain I-V and P-V characteristics of PV modules: for series and parallel connection of PV modules.
3. To observe the I-V and P-V curve of a solar cell/module with different light intensities and with different operating temperatures.
4. To design PV system for residential/commercial applications.
5. To develop the MATLAB simulation model of Perturb & Observe MPPT algorithm for a PV panel connected with DC-DC Boost converter through a resistive load.
6. To develop a MATLAB simulation model of Incremental conductance MPPT algorithm for a PV panel connected with DC-DC Boost converter through a resistive load.
7. Demonstrate voltage conversion using a rectifier circuit (AC – DC) and inverter circuit (DC - AC).
8. To demonstrate voltage conversion using a DC-DC converter (Buck/Boost).
9. To obtain torque-speed characteristics of a DC series motor using load variations.

10. To obtain torque-speed characteristics of a PMSM/SRM motor.
11. To perform the speed control of BLDC motor.
12. To perform the speed control of 3 Phase Induction motor by Variable frequency method.
13. To demonstrate generation of electricity during regenerative braking of a motor.
14. To plot the charging and discharging characteristics of a battery under different load conditions.
15. To determine the SoC of a battery pack by analyzing voltage and current readings at different discharge levels.
16. To observe temperature variations in a battery pack under different charging/discharging conditions.

Note: The list of experiments is not limited to the above, but a course coordinator may design a few new experiments based on recent technologies/trends in the relevant Engineering Domain. However, the course coordinator needs to get approval by the Program Assessment Committee and Chairman BOS/HOD well in time.

Books & Other Resources:

Text Books:

1. Chetan Singh Solanki, "Solar Photovoltaics: Fundamental, Technologies and applications", 2nd Edition, PHI Learning Pvt. Limited, New Delhi, 2011.
2. Solar Power Hand Book, Dr. H. Naganagouda (2014)
3. Renewable Energy Sources and Emerging Technologies, Kothari D.P. and Signal K.C New Arrivals –PHI; 2 Edition (2011)
4. "Electrical Vehicle", James Larminie and John Lowry, John Wiley & Sons
5. "Electric and Hybrid-Electric Vehicles", R. K. Jurgen, SAE International Publisher
6. "Power Electronics: Circuits, Devices and Applications" M. H. Rashid, Pearson Education

Reference Books:

1. "Solar Energy - Principles of thermal collection and storage", S. P. Sukhatme, TMH, 2008
2. Renewable Energy Technologies; A Practical Guide for Beginners
3. "Electric and Hybrid Vehicles: Design Fundamentals", Iqbal Hussein, CRC Press

4. "Power Electronics Converters Applications and Design", Ned Mohan, T. Undeland & W. Robbins, John Willey & sons
5. "Electric Motors and Drives Fundamentals Types and Applications", Austin Hughes and Bill Drury, Elsevier

Course Activity (Any one of the following):

1. Case study
2. Power point presentation.

Mr. A. V. Golande	Mr. R. S. Tarade	Mr. P. D. Upadhye
PAC Member 1	PAC Member 2	PAC Member 3

VPKBIET BARAMATI
Affiliated to S.P.P.U. Pune
Id No. / PU / PN / Engg. / 132 / 2008
PUNE (MS.)

HS23312: Democracy, Election, and Governance		
Teaching Scheme: **TH: 01 Hrs/Week**	**Audit Course**	**Examination Scheme:** **Nil**

Course Objectives:

1. Analyze the structure and role of democratic institutions.
2. Understand the electoral process and the role of the Election Commission of India.
3. Study the framework of governance in India, covering the executive, legislative, and judicial branches at both central and state levels.

Course Outcomes:

At the end of this course, student will be able to

CO-1: Explain the evolution and significance of democracy in India, its core principles, and its role in nation-building.
CO-2: Describe the composition, powers, and functions of the Election Commission of India, and understand the electoral process.
CO-3: Interprete the governance structures at the Union and State levels, covering executive, legislative, and judicial functions.

Course Contents

Unit I: Democracy in India **(4 Hrs)**

Evolution of Democracy, Dimensions of Democracy: Social, Economic and Political, Decentralisation: Grassroots Level Democracy, Challenges before Democracy: women and marginalized sections of the society.

Unit II: Election **(3 Hrs)**

Election Commission of India-composition, powers and functions, and electoral process. Types of emergency grounds, procedure, duration, and effects. Amendment of the constitution- meaning, procedure, and limitations.

Unit III: Governance **(6 Hrs)**

Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions. State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system Challenges of caste, gender, class, democracy and ethnicity

Books & Other Resources:

Reference Books:

1. Banerjee-Dube, I. (2014). A history of modern India. Cambridge University Press.
2. Bhargava, R. (2008). Political theory: An introduction. Pearson Education India.
3. Bhargava, R., Vanaik, A. (2010) Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan.
4. Chandhoke. N., Proyadardhi.P, (ed) (2009), 'Contemporary India: Economy, Society, Politics', Pearson India Education Services Pvt. Ltd, ISBN 978-81- 317-1929-9.
5. Chandra, B. (1999). Essays on contemporary India. Har-Anand Publications.
6. Chaterjee, P. (1997). State and Politics in India.
7. Dasgupta. S., (ed) (2011), 'Political Sociology', Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education in south Asia. ISBN: 978-317-6027- 7.
8. Deshpande, S. (2003). Contemporary India: A Sociological View, New Delhi:Viking Publication.
9. Guha, R. (2007). India After Gandhi: The History of the World's Largest. Democracy, HarperCollins Publishers, New York.
10. Guha, R. (2013). Gandhi before India. Penguin UK.
11. Jayal. N.G. (2001). Democracy in India.New Delhi: Oxford University Press.
12. Kohli, A. (1990). Democracy and discontent: India's growing crisis of governability. Cambridge University Press.
13. Kohli, A., Breman, J., & Hawthorn, G. P. (Eds.). (2001). The success of India's democracy (Vol. 6). Cambridge University Press.
14. Kothari, R. (1989). State against democracy: In search of humane governance. Apex Pr.
15. Kothari, R. (1970). Politics in India. New Delhi: Orient Blackswan.
16. Kothari, R. (1995). Caste in Indian politics. Orient Blackswan.
17. Sarkar, S. (2001). Indian democracy: the historical inheritance. the Success of India's Democracy, 23-46.

Evaluation Mechanism:

Since this is an **audit course**, evaluation will be based on active participation, understanding of concepts, and analytical skills:

1. **Assignments & Reports** – Writing assignments on topics like electoral reforms, democratic challenges, or constitutional amendments.
2. **Quizzes/MCQs** – Multiple-choice or short-answer questions covering key topics like the Election Commission, parliamentary proceedings, and governance.
3. **Group Discussions/Presentations**– Debates on issues like democracy and social justice, governance challenges, and the effectiveness of grassroots-level democracy.

Dr. A. B. Patil	Dr. R.K. Shastri	Dr. C. B. Nayak	Dr. S. M. Bhosle	Dr. S. B. Lande
Course Coordinator	HSSM BoS Chairman	Dean Autonomy	Dean Academics	Principal
VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati	VPKBIET, Baramati

VPKBIET BARAMATI

Principal
Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133