Mahatma Education Society's
Pillai HOC College of Engineering and Technology

Syllabus Authentication Request and Distribution Form

Syllabus Identity
(to be filled by librarian)

University : University of Mumbai Academic Council Item Date : 11/05/2017 Number : 4.183

Degree : Bachelor of Engineering Branch : Electrical Total Number of Pages : 68

Scheme CBGGS Year : FE / SE / TE / BE / ME of 2017-18 Semester: III & IV

Received Through University Courier [ ] Received Through Downloading from University Website [✓]

Librarian Name : A. G. Mane Signature : Date : 22/08/17

Syllabus Marked to Head of Department for Authentication

Head, Department of Electrical Engineering is requested to get the syllabus authenticated and submit back to the Principal.

Principal Signature : Date : 23/08/17

Authentication Certificate

- Syllabus has been verified with the University of Mumbai website.
- Certified that this syllabus is an authentic syllabus of the University of Mumbai for the concerned year.
- Submitted to the Principal.

HOD Name : P. R. Chavan Signature : Date : 23/08/17

Authenticated Syllabus Marked to the Concerned Head of Department for Distribution to Faculty Members

Head, Department of Electrical Engineering is requested to distribute the authenticated syllabus of the University of Mumbai to concerned faculty members for teaching purposes.

Principal Signature : Date : 09/09/17

AC 11/05/2017
Item No. 4.183

UNIVERSITY OF MUMBAI

Revised syllabus (Rev- 2016) from Academic Year 2016 -17
Under

FACULTY OF TECHNOLOGY

Electrical Engineering

Second Year with Effect from **AY 2017-18**
~~**Third Year** with Effect from **AY 2018-19**~~
~~**Final Year** with Effect from **AY 2019-20**~~

As per **Choice Based Credit and Grading System**
with effect from the AY 2016–17

MAHATMA EDUCATION SOCIETY'S
Pillai's HOC College of Engineering & Technology
LIBRARY

From Co-coordinator's Desk:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai, has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's), course objectives and course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of Studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, **Choice Based Credit and Grading System** is also introduced to ensure quality of engineering education.

Choice Based Credit and Grading System enable a much-required shift in focus from teacher-centric to learner-centric education. Since the workload estimated is based on the investment of time in learning, not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes. Faculty of Technology has devised a transparent credit assignment policy adopted ten points scale to grade learner's performance. **Choice Based Credit and Grading System** were implemented for First Year of Engineering (Undergraduate) from the academic year 2016-2017. Subsequently this system will be carried forward for Second Year of Engineering (Undergraduate) in the academic year 2017-2018 and so on.

Dr. Suresh K. Ukarande
Coordinator,
Faculty of Technology,
Member - Academic Council
University of Mumbai, Mumbai

Preamble:

The overall technical education in our country is changing rapidly in manifolds. Now it is very much challenging to maintain the quality of education with its rate of expansion. To meet present requirement a systematic approach is necessary to build the strong technical base with the quality. Accreditation will provide the quality assurance in higher education and to achieve recognition of the institution or program meeting certain specified standards. The main-focus of an accreditation process is to measure the program outcomes, essentially a range of skills and knowledge that a student will have at the time of graduation from the program that is being accredited. Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

I, as a Chairman, Board of Studies in Electrical Engineering of University of Mumbai, happy to state here that, Program Educational Objectives (PEOs) were finalized for undergraduate program in Electrical Engineering, more than ten senior faculty members from the different institutes affiliated to University of Mumbai were actively participated in this process. Few PEOs and POs of undergraduate program in Electrical Engineering are listed below;

Program Educational Objectives (PEOs)

- *Graduates will have successful career in industry or pursue higher studies to meet future challenges of technological development.*
- *Graduates will develop analytical and logical skills that enable them to analyze and design Electrical Systems and their Controls.*
- *Graduates will achieve professional skills to expose themselves by giving an opportunity as an individual as well as team.*
- *Graduates will undertake research activities in emerging multidisciplinary fields.*

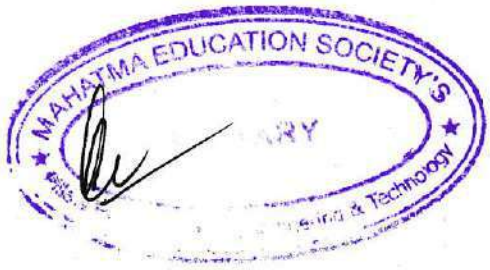
Program Outcomes (POs)

- **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

- **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Dr. S. R. Deore,
Chairman,
Board of Studies in Electrical Engineering,
Member - Academic Council
University of Mumbai



MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

Program Structure for
SE Electrical Engineering
University of Mumbai
(With Effect from 2017-18)

Scheme for Semester III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC301	Applied Mathematics - III	4	-	1	4	-	1	5
EEC302	Electronic Devices and Circuits	4	-	-	4	-	-	4
EEC303	Conventional and Non-Conventional Power Generation	3	-	1	3	-	1	4
EEC304	Electrical and Electronics Measurement	4	-	-	4	-	-	4
EEC305	Electrical Machine – I	4	-	-	4	-	-	4
EEL301	Electrical and Electronics Measurement Lab	-	2	-	-	1	-	1
EEL302	Object Oriented Programming and Methodology Lab	-	4#	-	-	2	-	2
EEL303	Electronics Lab - I	-	2	-	-	1	-	1
EEL304	Electrical Machine Lab- I	-	2	-	-	1	-	1
Total		**19**	**10**	**2**	**19**	**5**	**2**	**26**

 # Out of four hours, 2 hours theory shall be taught to entire class and 2 hours practical in batches

Examination Scheme for Semester III

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC301	Applied Mathematics - III	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC302	Electronic Devices and Circuits	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC303	Conventional and Non-Conventional Power Generation	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC304	Electrical and Electronics Measurement	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC305	Electrical Machine –I	80	32	20	8	-	-	-	-	-	-	-	-	100
EEL301	Electrical and Electronics Measurement Lab	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL302	Object Oriented Programming and Methodology Lab	-	-	-	-	25	10	-	-	-	-	50	20	75
EEL303	Electronics Lab - I	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL304	Electrical Machine Lab - I	-	-	-	-	25	10	-	-	-	-	25	10	50
	Total	**400**	**-**	**100**	**-**	**150**	**-**	**-**	**-**	**25**	**-**	**100**	**-**	**775**

BHARATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

Program Structure for
SE Electrical Engineering
University of Mumbai
(With Effect from 2017-18)

Scheme for Semester IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC401	Applied Mathematics - IV	4	-	1	4	-	1	5
EEC402	Power System - I	3	-	1	3	-	1	4
EEC403	Electrical Machines – II	4	-	-	4	-	-	4
EEC404	Electromagnetic Field and wave Theory	3	-	1	3	-	1	4
EEC405	Analog and Digital Integrated Circuits	3	-	-	3	-	-	3
EEC406	Electrical Network	3	-	1	3	-	1	4
EEL401	Simulation Lab - I	-	2	-	-	1	-	1
EEL402	Electrical Machines Lab - II	-	2	-	-	1	-	1
EEL403	Electronics Lab - II	-	2	-	-	1	-	1
EEL404	Electrical Workshop	-	2	-	-	1	-	1
Total		**20**	**8**	**4**	**20**	**4**	**4**	**28**

Examination Scheme for Semester IV

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC401	Applied Mathematics - IV	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC402	Power System - I	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC403	Electrical Machines - II	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC404	Electromagnetic Field and wave Theory	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC405	Analog and Digital Integrated Circuits	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC406	Electrical Network	80	32	20	8	25	10	-	-	-	-	-	-	125
EEL401	Simulation Lab - I	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL402	Electrical Machines Lab - II	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL403	Electronics Lab - II	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL404	Electrical Workshop	-	-	-	-	25	10	-	-	25	10	-	-	50
Total		**480**	-	**120**	-	**200**	-	-	-	**50**	-	**50**	-	**900**

MAHATMA EDUCATION SOCIETY'S ... Engineering & Technology

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Tutorial	Theory	Tutorial	Total
EEC301	Applied Mathematics-III (abbreviated as AM-III)	4	1	4	1	5

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC301	Applied Mathematics-III	20	20	20	80	3	25	125

Course Objectives	• To Develop knowledge and skill based foundation in Mathematics amongst students needed for the field of Electrical Engineering • To provide students with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems. • To prepare student to apply reasoning informed by the contextual knowledge to Electrical Engineering practice. • To prepare students to work as part of teams on multi-disciplinary projects.
Course Outcomes	Students will be able • To demonstrate basic knowledge of Laplace Transform, Fourier series, Bessel Functions, Vector Algebra and Complex Variable. • To identify and Model the problems of the field of Electrical Engineering and solve it.

Module	Contents	Hours
1	**Laplace Transform** **Laplace Transform (LT) of Standard Functions:** Definition of Laplace transform, Condition of Existence of Laplace transform, Laplace transform of $e^{at}, Sin(at), \cos(at), \sinh(at), \cosh(at), t^n$ Heaviside unit step function, Dirac-delta function, Laplace transform of Periodic function **Properties of Laplace Transform:** Linearity, first shifting theorem, second shifting theorem, multiplication by t^n ,Division by t, Laplace Transform of derivatives and integrals, change of scale, convolution theorem, Evaluation of integrals using Laplace transform.	07
2	**Inverse Laplace Transform & its Applications:** Partial fraction method, Method of convolution, Laplace inverse by derivative. **Applications of Laplace Transform:** Solution of ordinary differential equations, Solving RLC circuit differential equation of	06

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

	first order and second order with boundary condition using Laplace transform (framing of differential equation is not included).	
3	**Fourier Series:** **Introduction:** Orthogonal and orthonormal set of functions, Introduction of Dirichlet's conditions, Euler's formulae. **Fourier Series of Functions:** Exponential, trigonometric functions of any period =2L, even and odd functions, half range sine and cosine series Complex form of Fourier series, Fourier integral representation, Fourier Transform and Inverse Fourier transform of constant and exponential function.	11
4	**Vector Algebra & Vector Differentiation:** **Review of Scalar and Vector Product**: Scalar and vector product of three and four vectors, Vector differentiation, Gradient of scalar point function, Divergence and Curl of vector point function. **Properties:** Solenoidal and irrotational vector fields, conservative vector field.	07
5	**Vector Integral** Line integral, Green's theorem in a plane, Gauss' divergence theorem and Stokes' theorem	06
6	**Complex Variable & Bessel Functions:** **Analytic Function:** Necessary and sufficient conditions (No Proof), Cauchy Reiman equation Cartesian form (No Proof) Cauchy Reiman Equation in polar form (with Proof), Milne Thomson Method and it application, Harmonic function, orthogonal trajectories. **Mapping:** Conformal mapping, Bilinear transformations, cross ratio, fixed points **Bessel Functions:** Bessel's differential equation, Properties of Bessel function of order +1/2 and -1/2, Generating function, expression of $\cos(x\sin\theta)$, $\sin(x\sin\theta)$ in term of Bessel functions	11

Books Recommended:

Text books:

1. H.K. Das, "Advanced engineering mathematics",S . chand , 2008
2. A. Datta, *"Mathematical Methods in Science and Engineering"*, 2012
3. B.S. Grewal, *"Higher Engineering Mathematics"*, Khanna Publication

Reference Books:

1. B. V. Ramana, *"Higher Engineering Mathematics"*, Tata Mc-Graw Hill Publication
2. Wylie and Barret, *"Advanced Engineering Mathematics"*, Tata Mc-Graw Hill 6th Edition
3. Erwin Kreysizg, *"Advanced Engineering Mathematics"*, John Wiley & Sons, Inc
4. Murry R. Spieget, *"Vector Analysis"*, Schaum's outline series, Mc-Graw Hill Publication

MAHATMA EDUCATION SOCIETY'S LIBRARY

Assessment:
Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:
Term work shall consist of minimum eight tutorials and assignments (minimum 2).
The distribution of marks for term work shall be as follows:

Tutorials	:15 marks
Assignments	:05 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures minimum passing in the term work.

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S LIBRARY PVPP COE College of Engineering & Technology

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC302	**Electronic Devices and Circuits (abbreviated as EDC)**	**4**	**-**	**4**	**-**	**4**

Course Code	Course Name	Examination Scheme						
		Theory						
		Internal Assessment			End Sem. Exam	Exam. Duration (Hrs.)	Term Work	Total
		Test 1	Test 2	Avg.				
EEC302	Electronic Devices and Circuits	20	20	20	80	3	-	100

Course Objectives	• To teach the basic concept of various electronic devices, circuits and their application • To develop ability among students for problem formulation, system design and solving skills
Course Outcomes	Students will be able • To Identify the different types of diodes and their applications in electronic circuits • To analyze the dc and ac parameters of BJT JFET, and differential amplifiers • To demonstrate and analyze the effects of various parameters on performance of BJT and JFET amplifier. • To analyze the effects of negative feedback in BJT and JFET amplifiers. • To identify the effects of cascading in BJT and JFET amplifiers. • To analyze the different types of oscillators.

Module	Contents	Hours
1	**Diode:** Basic construction, Operation and characteristics of diode, Application of diode as clipper and clampers, Construction, Principle of operation and application of special diode – 1) Zener, 2) LED, 3) Schottky, 4) Photodoide. Full Wave Bridge Rectifier with and without Filter, Analysis: specification of the devices and components required for C, LC, CLC filter.	08
2	**Bipolar Junction Transistor:** Construction and Characteristics of various configurations of	14

MAHARAJA EDUCATION SOCIETY'S LIBRARY Institute of Engineering & Technology

	BJT. Biasing Circuits: Types, dc circuit analysis, load line, thermal runaway, stability factor analysis, thermal stabilization and Compensation. Modeling: Small signal analysis of CE configurations with different biasing network using h-parameter model. Introduction to re-model and hybrid-pi model. Amplification derivation of expression for voltage gain, current gain, input impedance and output impedance of CC, CE amplifiers, Study of frequency response of BJT amplifier.	
3	**Field Effect Transistor:** Types, construction and their characteristics, Biasing circuits for FET amplifiers, FET small signal analysis, derivation of expressions for voltage gain and output impedance of CS amplifiers. MOSFET- Types, construction and their characteristics	08
4	**Feedback Amplifier:** Introduction to positive and negative feedback, negative feedback -current, voltage, Series and Shunt type. It's effect on input impedance, output impedance, voltage gain, current gain and bandwidth	07
5	**Cascade amplifiers:** Types of coupling, effect of coupling on performance of BJT and JFET amplifiers, Darlington-pair	03
6	**Oscillators:** Positive feedback oscillators, frequency of oscillation and condition for sustained oscillations of a) RC phase shift, b)Wien bridge, c)Hartley/ Colpitts with derivations, crystal Oscillator, UJT relaxation oscillator	08

Books Recommended:

Text Books:

1. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuits*, Prentice-Hall of India.
2. Millman and Halkias, '*Electronic Devices and Circuits*', Tata McGraw-Hill.
3. David Bell, *Electronic Devices and Circuits*, Oxford University Press

Reference Books:

1. Thomas Floyd, '*Electronic Devices*', Prentice-Hall of India
2. Ramakant A. Gayakwad, *Op-Amps and Linear Integrated Circuits*
3. Neamen D.A., *Electronic Circuit Analysis and Design*, McGraw Hill International.
4. S. Salivahanan, N. Suresh Kumar, "*Electronic Devices and Circuits*" *TMH*

Assessment:

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S LIBRARY

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC303	**Conventional and Non-Conventional Power Generation (abbreviated as CNCPG)**	**3**	**1**	**3**	**1**	**4**

Course Code	Course Name	Examination Scheme						
		Theory					Term work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC303	Conventional and Non-conventional Power Generation	20	20	20	80	03	25	125

Course Objectives	• To impart the knowledge of basics of different types of power generation & power plants in detail so that it helps them in industry oriented learning
Course outcomes	Students will be able • To analyse the economics of power generation • To illustrate, the operation of thermal power plant • To describe, the classification of hydro power plant and significance of hydrograph • To illustrate, the operation of nuclear power plant • To compare the operation of Diesel and Gas Turbine power plant. • To illustrate operation of various Non-Conventional Energy sources

Module	Contents	Hours
1	**Conventional and Non- Conventional sources of energy** Present energy scenario worldwide and Indian perspective. **Economics of the power plant** Load curve, load duration curve, various factors and effects of fluctuating load on operation and methods of meeting fluctuating load. Selection of generating equipment, depreciation of plant, cost of electrical energy-Fixed and operating cost of different plants, effect of load factor on unit cost. Role of load diversity in power system economy and basic tariff methods **(*Numerical).**	05

MAHATMA EDUCATION SOCIETY'S Pillai's HOC College of Engineering & Technology LIBRARY

2	**Thermal power plant** Law of Thermodynamics. Analysis of steam cycle-Carnot, Rankine. PV and TS diagram, Reheat cycle and Regenerative cycle. Layout of power plant. Selection of site, Lay out of Coal handling Plant, pulverized coal handling, Fluidized bed combustion, Ash handling, Dust collection, Forced draught and induced draught fans, Water tube Boiler and Fire tube boiler. Impulse turbine and reaction turbine. Accessories: Feed pump, injector, economizer, air preheater, super heater, steam separator, Direct contact condensers and Surface condenser, and cooling towers.	09
3	**Hydro power plant** Rainfall, run off and its measurement hydrograph, flow duration curve, mass curve, reservoir storage capacity, layout of hydroelectric power plant, Selection of site, classification of hydro power plant, construction and working of turbine-Pelton, Kaplan, Francis. **(*Numerical)**	05
4	**Nuclear power plant** Introduction of nuclear engineering, fission, fusion, nuclear materials, thermal fission reactor, layout of nuclear power plant, Selection of site, PWR, BWR, reactor control, introduction to liquid metal, fast breeder reactors and plasma technology.	06
5	**Gas turbine and Diesel power plant** Brayton cycle operation, Layout of gas turbine power plant, types of gas turbine power plant. Diesel cycle, Principle of Diesel power plant, layout, significance of components of diesel power plant. Comparison with gas turbine power plants in terms of advantages and disadvantages	04
6	**Power Generation using non-conventional energy sources** **Solar Energy** Solar Flat plate collectors, Solar concentrators, Dish and Parabolic trough concentrating generating systems, Central tower solar thermal power plants. Basic principle of power generation in a PV cell, Band gap and efficiency of PV cells solar cell characteristics. **Wind Energy** Basic component of WEC, Types of wind turbine-HAWT, VAWT, Performance parameters of wind turbine, Power in wind, Wind electric generators and site selection. **Fuel Cell** Introduction to fuel cell, principle of operation of fuel cell, Types of fuel cell **Other sources** Basics of power generation: Biomass, geothermal and tidal energy sources and OTEC.	07

Note: *Numerical should be covered in tutorials.

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

Books Recommended:

Text Books:

1. MV Deshpande, *Elements of Power station design,* Tata McGraw Hill

2. DH Bacon, *Engineering Thermodynamics,* London Butterworth

3. PK Nag, *Power Plant Engineering-Steam & Nuclear,* Tata McGraw Hill

Reference Books:

1. Fredrick T Morse, *Power Plant Engineering,* East-West Press Pvt Ltd

2. Mahesh Verma, *Power Plant Engineering,* Metrolitan Book Co Pvt Ltd

3. RK Rajput, *A Text Book of Power System engineering,* Laxmi Publication

4. George W Sutton-(Editor), *Direct Energy Conversion,* Lathur University, Electronic Series Vol 3, McGraw Hill

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Term work:

Term work shall consist of minimum two group assignments followed by seminar, report on power plant visit and four tutorials based on the syllabus. The distribution of marks for term work shall be as follows:

Tutorial and Visit	:10 marks
Assignments and Seminar	:10 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures minimum passing in the term work.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

University of Mumbai						
Course code	**Course Name**	**Teaching scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC304	**Electrical and Electronics Measurement (abbreviated as EEM)**	**4**	**-**	**4**	**-**	**4**

Course Code	Course Name	Examination Scheme						
		Theory					Term work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC304	Electrical and Electronics Measurement	20	20	20	80	03	-	100

Course Objectives	• Students should be able to understand working principles of various analog and digital instruments & devices used for measurement of the various electrical parameters. • To understand the measurement of physical parameters using sensors.
Course Outcomes	Students will be able • To illustrate the working principle of measurement instruments. • To analyse the working of various analog and digital instruments in electrical measurements. • To analyse the concept of extension of range of meters used in electrical measurements. • To analyse the performance of bridges used in electrical measurement process. • To illustrate the need for calibration process in instruments. • To analyse the performance of transducers involved in electrical measurement.

Module	Content	Hours
1	**Principles of Analog Instruments:** Errors in Measurement, Difference between Indicating and Integrating Instruments. Moving coil and Moving iron Instruments, Ammeters Shunts & Voltmeter Multiplier. Extension of ranges by using shunt, Multipliers, Dynamometer type Wattmeter & Power Factor meters. Reed Moving Coil type Frequency Meters. Weston type Synchroscope. DC Permanent magnet moving coil type Galvanometers. Ballistic	16

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

	Galvanometer and AC Vibration Galvanometer **(only the basic working Principle and Applications).**	
2	**Principles of Digital Instruments:** Advantages of digital meters over analogue meters. Resolution & sensitivity of digital meters. Working principles of digital Voltmeter, Ammeter, Frequency meter, Phase Meter, Energy meter, Tachometer and Multi-meter.	10
3	**Measurement of Resistance:** Wheatstone's Bridge, Kelvin's Double Bridge and Megger.	05
4	**Measurement of Inductance & Capacitance:** Maxwell's Inductance bridge, Maxwell's Inductance & Capacitance Bridge, Hay's bridge, Anderson's Bridge, Desaugthy's Bridge, Schering Bridge and Q meter	05
5	**Potentiometer:** Basic potentiometer circuit, standardization, Crompton's Type Potentiometer and its applications for calibration of Ammeter, Voltmeter and Wattmeter and measurement of resistance and power.	04
6	**Transducers:** Electrical Transducers, Active & Passive Transducers, Resistive Transducer-Potentiometer, Resistance Pressure Transducer, Resistive Position Transducer, Temperature Transducer- Resistance Thermometer, Thermistor, Thermo couple, RTD, Inductive Transducer-Using Self Inductance, Variable Reluctance type, Differential Output Transducers, LVDT, RVDT, Capacitive Transducer-Capacitive Pressure Transducer Piezo Electric Transducer, Photo Electric Transducer (Photo emissive, Photo Conductive, Photo Voltaic)	08

Books Recommended:

Text Books:

1. Electrical & Electronic Measurements and Instrumentation by AK Sawhney, Dhanpat Rai & Sons
2. Modern Electronic Instrumentation and Measurement Techniques by Helfric and Cooper, Prentice Hall of India
3. Electronic Instrumentation By H.S.Kalsi, Third Edition, Tata McGraw Hill

Reference Books:

1. Principle of Measurement & Instrumentation by Alan.S.Moris, Prentice Hall of India
2. Electrical Measurement & Instrumentation by RS Sirohi & Radhakrisnan, New Age International

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai HOC College of Engineering & Technology

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S LIBRARY Engineering & Technology

University of Mumbai						
Course code	**Course Name**	**Teaching scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC305	**Electrical Machine-I (abbreviated as EMC-I)**	**4**	**-**	**4**	**-**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs.)		
		Test 1	Test 2	Avg.				
EEC305	Electrical Machines-I	20	20	20	80	3	-	100

Course Objectives	• Students should understand the concepts of DC machines, Reluctance motor, Stepper motors and their applications. • To impart industry oriented learning.
Course Outcomes	Students will be able • To analyze series parallel magnetic circuits to determine circuit parameters and losses. • To illustrate principle of energy conversion in single and double excited machines. • To understand the performance parameters of dc machines. • To analyze the effect of performance parameters and application of dc motors. • To analyze the performance of dc machines by conducting various test. • To illustrate the principle of operation and applications of stepper motors.

Module	Contents	Hours
1	**Basics of Magnetism** Magnetic field, Magnetic circuit, Numerical from series parallel magnetic circuit, Flux linkage, Inductance and energy, Faraday's laws, Hysteresis and eddy current losses.	04
2	**Electromechanical Energy Conversion** Principle, Energy stored in magnetic field, Torque in singly excited magnetic field, Reluctance motor, Doubly excited magnetic field, Torque from energy and Co- energy. Dynamic equations	08
3	**DC Machines** Construction of machine, Basic design concept of lap and wave winding, Principle of operation, Significance of commutator and	10

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

	brushes, EMF and torque equation, concept of back EMF, Armature reaction, Methods to minimize the effect of Armature reaction, Process of commutation, Methods to improve commutation.	
4	**DC Motor** Characteristics of DC Motors, speed-torque characteristic equations (Drives approach), Electrical braking (Rheostatic, regenerative and plugging with numerical and speed-torque characteristic equation), Necessity of starter, concept of soft starting, Block diagram of soft starter, Speed control of DC shunt and series motor, losses and efficiency, Applications of DC motor.	14
5	**Testing of DC Motor** Retardation, Brake load, Swinburne, Hopkinson's and field test.	06
6	**Stepper Motor** Working principle, construction of stepper motor, Classification, Variable reluctance stepper motor (VRSM), Permanent magnet stepper motor, Characteristics of stepper motor (Static and dynamic characteristic) Applications of stepper motor. **(No Numerical)**	06

Books Recommended:

Text Books:

1. Bimbhra P. S., *Electric Machinery* , Khanna Publisher,
2. Bimbhra P. S., *Generalized Machine Theory*, Khanna Publisher,
3. E. G. Janardanan, *Special Electrical Machines,* PHI
4. S. K. Pillai, *A first course on Electrical Drives,* New age publication
5. V. K. Mehta, *Principles of Electrical Machines,* S Chand Publication
6. G. K. Dubey, *Fundamentals of Electrical Drives*, Narosa Publication

Reference Books:

1. M. G. Say and E. O. Taylor, *Direct current machines*, Pitman publication
2. Ashfaq Husain, *Electric Machines*, Dhanpat Rai and co. publications
3. M. V. Deshpande, *Electric Machines*, PHI
4. Vedam Subramanyam, *Electrical Drive-concept and applications*, TMH Publication
5. A. E. Fitzgerald, Kingsly, Stephen., *Electric Machinery,* Tata McGraw Hill
6. K. Venkatratnam, *Special Electrical Machines,*

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL301	**Electrical and Electronics Measurement Lab (abbreviated EEM Lab)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL301	Electrical Network and Measurement Lab	-	-	-	-	25	-	25	50

Course Objectives	• Students should be able to understand working principles of various analog and digital instruments & devices used for measurement of the various electrical parameters. • To understand the measurement of physical parameters using sensors.
Course Outcomes	Students will be able • To illustrate the working principle of bridges • To do measurement of various electrical circuit parameters. • To calibrate various electrical measuring instruments. • To illustrate the concept of extension of range of meters used in electrical measurements. • To do the measurement of various process parameters. • To illustrate the working principle of sensors

Syllabus: Same as that of Course EEC304 Electrical and Electronics Measurement

Suggested List of Laboratory Experiments:

1. Measurement of the medium resistance using Wheatstone Bridge.
2. Measurement of the low resistance using Kelvin's Double Bridge.
3. Measurement of inductance using Maxwell's Bridge.
4. Measurement of inductance using Hay's Bridge.
5. Measurement of inductance using Anderson's Bridge.
6. Measurement of capacitance using Desauty's bridge.

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

7. Measurement of capacitance using Schering's bridge.
8. Calibration of Crompton DC Potentiometer.
9. Calibration of Ammeter/Voltmeter/Wattmeter using Potentiometer.
10. To measure output voltage and displacement using LVDT and draw graph to verify the characteristics of output voltage Vs Displacement.
11. Measurement of temperature using RTD.
12. To Study various Thermocouples and Estimate their Response times.
13. Calibration of single phase energy meter by direct loading.
14. To measure output voltage and force using strain gauge and draw graph to verify the characteristics of force Vs Output voltage.

Any other experiment based on syllabus which will help students to understand topic/concept.

Term Work:

Term work shall consist of minimum 8 experiments. The distribution of marks for term work shall be as follows:

Experiments Performance	:10 Marks
Journal	:10 Marks
Attendance (Theory and Practical)	:05 Marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Oral Examination:

Oral examination will be based on entire syllabus.

LIBRARY

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL302	**Object Oriented Programming and Methodology Lab (abbreviated OOPM Lab)**	-	**4#**	-	**2**	**2**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL302	Object Oriented Programming and Methodology Lab	-	-	-	-	25	50	-	75

Course Objectives	• To learn the object oriented programming concepts • To study various java programming constructs like multithreading, exception handling, packages etc. • To explain components of GUI based programming.
Course Outcomes	Students will be able • To apply fundamental programming constructs. • To illustrate the concept of packages, classes and objects. • To elaborate the concept of strings, arrays and vectors. • To implement the concept of inheritance and interfaces. • To implement the notion of exception handling and multithreading. • To develop GUI based application.

- **Prerequisite:** Structured Programming Approach

Module	Content	Hours
1	**OO Concepts:** Object, Class, Encapsulation, Abstraction, Inheritance, Polymorphism. **Features of Java, JVM** **Basic Constructs/Notions:** Constants, variables and data types, Operators and Expressions, Revision of Branching looping	02
2	**Classes, Object and Packages** Class, Object, Method.	05

MAHATMA EDUCATION SOCIETY'S Pillai's HOC College of Engineering & Technology LIBRARY

	Constructor, Static members and methods Passing and returning Objects Method Overloading Packages in java, creating user defined packages, access specifiers.	
3	**Array, String and Vector** Arrays, Strings, String Buffer Wrapper classes, Vector	04
4	**Inheritance and Interface** Types of Inheritance, super keyword, Method Overriding, abstract class and abstract method, final keyword, Implementing interfaces, extending interfaces	03
5	**Exception Handling and Multithreading** Error vs Exception, try, catch, finally, throw, throws, creating own exception Thread lifecycle, Thread class methods, creating threads, Synchronization	04
6	**GUI programming in JAVA** **Applet:** Applet life cycle, Creating applets, Graphics class methods, Font and Color class, parameter passing. **Event Handling:** Event classes and event listener **Introduction to AWT:** Working with windows, Using AWT controls- push Buttons, Label, Text Fields, Text Area, Check Box, and Radio Buttons.	06

Suggested List of Programming Assignments / Laboratory Work:

1. Program on various ways to accept data through keyboard and unsigned right shift operator.
2. Program on branching, looping, labelled break and labelled continue.
3. Program to create class with members and methods, accept and display details for single object.
4. Program on constructor and constructor overloading
5. Program on method overloading
6. Program on passing object as argument and returning object
7. Program on creating user defined package
8. Program on 1D array
9. Program on 2D array
10. Program on String
11. Program on StringBuffer
12. Program on Vector
13. Program on single and multilevel inheritance (Use super keyword)
14. Program on abstract class
15. Program on interface demonstrating concept of multiple inheritance
16. Program on dynamic method dispatch using base class and interface reference.
17. Program to demonstrate try, catch, throw, throws and finally.
18. Program to demonstrate user defined exception

MAHATMA EDUCATION SOCIETY'S LIBRARY

19. Program on multithreading
20. Program on concept of synchronization
21. Program on Applet to demonstrate Graphics, Font and Color class.
22. Program on passing parameters to applets
23. Program to create GUI application without event handling using AWT controls
24. Program to create GUI application with event handling using AWT controls
25. Mini Project based on content of the syllabus. (Group of 2-3 students)

Any other experiment based on syllabus which will help students to understand topic/concept.

Term Work:
Term work shall consist of minimum 16 experiments, assignments (min 2) and class test. The distribution of marks for term work shall be as follows:

Experiments Performance	:10 marks
Assignments	:05 marks
Class Test	:05 marks
Attendance	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Practical/Oral Examination:
Practical/Oral examination will be based on entire syllabus.

LIBRARY

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
EEL303	Electronics Lab-I (abbreviated EL Lab-I)	-	2	-	1	1

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL303	Electronics Lab-I	-	-	-	-	25	25	-	50

Course Objectives	• To understand the basic concept of various electronic devices, circuits and their application. • To develop ability among students to design and implement electronic circuits.
Course Outcomes	Student will be able • To identify the different types of semiconductor devices and demonstrate their applications in electronic circuits. • To determine the dc and ac parameters of semiconductor devices and differential amplifiers. • To analyze the performance of different types of rectifier with and without filter. • To plot frequency response of BJT and JFET amplifier. • To analyze effect of feedback on the performance of amplifier. • To analyze the performance of different type of oscillators

Syllabus: Same as that of Course EEC302 Electronic Devices and Circuits

Suggested List of Laboratory Experiments:

1. Study of V-I characteristics of standard PN junction diode, zener diode, schottkey diode.
2. Use of diode as clipper and clamper
3. Rectifier- Filter performance analysis
4. BJT biasing network stability analysis
5. BJT Input and Output Characteristics for CE/CB/CC configuration
6. Frequency response of BJT CE amplifier
7. Study of JFET characteristics and calculation of parameters
8. Study of MOSFET characteristics and calculation of parameters

9. Frequency response of JFET CS amplifier
10. Study of negative feedback on amplifier performance
11. Study of photo devices applications
12. Study of differential BJT amplifier
13. Study of Darlington pair amplifier
14. Study of a RC phase shift oscillator
15. Study of a Wien Bridge oscillator
16. Study of a Hartley/Colpitts oscillator

Any other experiment based on syllabus which will help students to understand topic/concept.

Term work:

Term work shall consist of minimum 10 experiments. The distribution of marks for term work shall be as follows:

Experiments performance	:10 marks
Journal	:10 marks
Attendance	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Practical/Oral Examination:

Practical/Oral examination will be based on entire syllabus.

MAHATMA EDUCATION SOCIETY
LIBRARY
College of Engineering & Techno

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Practical	Theory	Practical	Total
EEL304	Electrical Machine Lab-I (abbreviated EMC Lab-I)	-	2	-	1	1

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL304	Electrical Machine Lab-I	-	-	-	-	25	25	-	50

Course Objectives	• Students should understand the concepts of DC machines, Reluctance motor, Stepper motors and their applications. • To impart industry oriented learning.
Course Outcomes	Students will be able • To demonstrate different speed control methods of dc motors. • To illustrate and analyze the performance of dc motors.

Syllabus: Same as EEC-305 (Electrical Machines-I)

Suggested List of Laboratory Experiment:

1. Speed control of DC shunt motor.
2. Load test on DC shunt motor.
3. Load test on DC series motor.
4. Load test on DC compound motor.
5. Brake test on DC motor.
6. Open circuit and load characteristic of DC shunt generator.
7. Rheostatic braking of DC motor.
8. Plugging of DC motor.
9. Retardation test of DC motor.
10. Swinburne's test on DC motor.
11. Hopkinson's test on DC motor.
12. Study of Stepper motor drive.
13. Field test

Any other experiment based on syllabus which will help students to understand topic/concept.

Term work:

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

Term work shall consist of minimum 8 experiments. The distribution of marks for term work shall be as follows:

Experiments performance	:10 marks
Journal	:10 marks
Attendance	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Practical/Oral Examination:

Practical/Oral examination will be based on entire syllabus.

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai HOC College of Engineering & Technology

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Tutorial	Theory	Tutorial	Total
EEC401	Applied Mathematics-IV (abbreviated as AM-IV)	4	1	4	1	5

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs)		
		Test 1	Test 2	Avg				
EEC401	Applied Mathematics-IV	20	20	20	80	3	25	125

Course Objectives	• To develop analytical insight of the student to prepare them for graduates studies in Electrical Engineering. • To enhance their ability to solve and analyze Electrical Engineering problem. • To provide students with a strong mathematical foundation to acquire the professional competence knowledge and skills.
Course Outcomes	Students will be able • To develop the proactive approach towards the selection of methods to a solution of engineering problems. • To identify different probability distribution, learn sampling technique, compute Eigen values and Eigen vectors and evaluate complex integrals and use their application in Electrical Engineering problems.

Pre-requisites:
Basics of Complex numbers, Analytic Function, Matrices, Symmetric, Orthogonal and Unitary matrices, Rank, Normal form, Solution of system of linear equations, L. I. & L. D. vectors, Basics of Probability.

1		**Calculus of Variation:**	**06**
	1.1	Euler's Langrange equation, solution of Euler's Langrange equation (only results for different cases for Function) independent of a variable, independent of another variable, independent of differentiation of a variable and independent of both variables	
	1.2	Isoperimetric problems, several dependent variables	
	1.3	Functions involving higher order derivatives: Rayleigh-Ritz method	
2		**Linear Algebra: Vector Spaces**	**06**
	2.1	Vectors in n-dimensional vector space: properties, dot product, cross product, norm and distance properties in n-dimensional vector space.	
	2.2	Vector spaces over real field, properties of vector spaces over real field, subspaces.	

LIBRARY Pillai's HOC College of Engineering & Technology

	2.3	The Cauchy-Schwarz inequality, Orthogonal Subspaces, Gram-Schmidt process.	
3		**Linear Algebra: Matrix Theory**	10
	3.1	Characteristic equation, Eigen values and Eigen vectors, properties of Eigen values and Eigen vectors	
	3.2	Cayley-Hamilton theorem (without proof), examples based on verification of Cayley- Hamilton theorem.	
	3.3	Similarity of matrices, Diagonalisation of matrices.	
	3.4	Functions of square matrix, derogatory and non-derogatory matrices.	
4		**Probability**	10
	4.1	Baye's Theorem (without proof)	
	4.2	Random variable: Probability distribution for discrete and continuous random variables, Density function and distribution function, expectation, variance.	
	4.3	Moments, Moment Generating Function.	
	4.4	Probability distribution: Binomial distribution, Poisson & normal distribution (For detailed study)	
5		**Correlation**	04
	5.1	Karl Pearson's coefficient of correlation, Covariance, Spearman's Rank correlation,	
	5.2	Lines of Regression.	
6		**Complex integration**	12
	6.1	Complex Integration: Line Integral, Cauchy's Integral theorem for simply connected regions, Cauchy's Integral formula.	
	6.2	Taylor's and Laurent's Series	
	6.3	Zeros, singularities, poles of f(z), residues, Cauchy's Residue theorem.	
	6.4	Applications of Residue theorem to evaluate real Integrals of different types.	

Reference Books:

Text books:

1. H.K. Das, "*Advanced engineering mathematics*", S . Chand, 2008
2. A. Datta, *"Mathematical Methods in Science and Engineering"*, 2012
3. B.S. Grewal, *"Higher Engineering Mathematics"*, Khanna Publication
4. P.N.Wartilar & J.N.Wartikar, "*A Text Book of Applied Mathematics*" Vol. I & II, Vidyarthi Griha Prakashan., Pune.

Reference Books:

1. B. V. Ramana, *"Higher Engineering Mathematics"*, Tata Mc-Graw Hill Publication
2. Wylie and Barret, *"Advanced Engineering Mathematics"*, Tata Mc-Graw Hill 6th Edition
3. Erwin Kreysizg, *"Advanced Engineering Mathematics"*, John Wiley & Sons, Inc
4. Seymour Lipschutz "*Beginning Linear Algebra*" Schaum's outline series, Mc-Graw Hill Publication

MAHATMA EDUCATION SOCIETY'S Pillai HOC College of Engineering & Technology LIBRARY

5.Seymour Lipschutz "*Probability*" Schaum's outline series, Mc-Graw Hill Publication

Assessment:
Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:
Term work shall consist of minimum eight tutorials and assignments (minimum 2).
The distribution of marks for term work shall be as follows:

Tutorials	:15 marks
Assignments	:05 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures minimum passing in the term work.

Theory Examination:
1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC402	**Power System-I (abbreviated as PS-I)**	**3**	**1**	**3**	**1**	**4**

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs)		
		Test 1	Test 2	Avg				
EEC402	Power System-I	20	20	20	80	3	25	125

Course Objectives	• To learn Basic structure of electrical power systems, different component of power system network. • To get knowledge of mechanical and electrical design of transmission systems. • To learn representation of transmission systems for performance evaluation.
Course Outcomes	Students will be able • To illustrate the general structure of power system. • To illustrate purpose of different mechanical components of overhead transmission lines. • To determine transmission line parameters for different configurations. • To analyze the performance of short, medium and Long transmission lines. • To analyze the performance of transmission line for different loading conditions. • To illustrate safety norms and regulations related to underground cables and grounding techniques.

Module	Contents	Hours
1	**Introduction:** Basic structure of power system: generation, transmission and distribution, single line diagram of typical AC supply system, comparison between AC and DC supply system, various system of electric power transmission, choice of economic voltage for transmission, Transmission and Distribution network in India.	02
2	**Mechanical Design of Overhead lines:** Main component of overhead lines, line supports, span, conductor configuration, sag in overhead lines, calculation of sag for equal and unequal supports, effect of ice and wind loading, insulators, type of insulators, potential distribution across insulator string, string	07

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

	efficiency, methods for improving string efficiency **(*Numerical)**	
3	**Transmission Line Parameters:** Resistance of transmission line, skin effect, proximity effect Definition of inductance, Internal and external flux linkage of single conductor, inductance of single phase two wire line, composite and bundled conductor, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of GMR and GMD, necessity of transposition, inductance of three phase double circuit line with symmetrical and unsymmetrical spacing, inductance of bundle conductor Capacitance of transmission line, capacitance of single phase line, capacitance of three phase line with symmetrical and unsymmetrical spacing, effect of earth on transmission line capacitance **(*Numerical)**	12
4	**Representation of power system components:** Introduction, single phase solution of balanced three phase networks, One-Line diagram and Impedance or reactance diagram, Per Unit(P.U.)system, advantage of Per Unit system ,p.u. impedance diagram, representation of load **(*Numerical)**	03
5	**Performance of Transmission Line:** Classification and modelling of short, medium and long lines, regulation and efficiency of short and medium lines, Ferranti effect, evaluation and estimation of generalized circuit constant(ABCD) for short and medium lines, surge impedance loading, tuned power line, Power circle diagram **(*Numerical)**	07
6	**Underground Cable and Power System Earthing:** **Underground Cable:** Classification and construction of cable ,insulation resistance of cable, capacitance of single core and three core cable, grading of cable, intersheath grading, capacitance grading **Power system Earthing:** Earthing definition, soil resistivity, step and touch potentials, measurement of earth resistance, soil resistivity, neutral grounding and its methods.	05

Note: *Numerical should be covered in Tutorials.

Books Recommended:

Text Books:

1. Wadhwa C.L. 'Electrical power system', New Age International,4th edition,2005
2. J B. Gupta, 'A Course In Power Systems', S. K. Kataria & Sons, 2009
3. Soni M.L., Bhatanagar U.S, Gupta P.V, 'A course in electrical power', Dhampat Rai and Sons., 1987
4. D. P. Kothari, I. J. Nagrath, 'Modern Power System Analysis', Mc Graw Hill
5. B.R. Gupta, 'Power System Analysis And Design', S.Chand

MAHATMA EDUCATION SOCIETY LIBRARY

Reference Books:

1. Stevenson, Modern power system analysis, TMH publication
2. Mehta V.K., Principle of power system, S Chand

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

Term work:

Term work shall consist of minimum eight tutorials and assignments (min two). The distribution of marks for term work shall be as follows:

Tutorial	:15 marks
Assignments	:05 marks
Attendance (Theory and Tutorial)	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S
LIBRARY
College of Engineering & Technology

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Tutorial	Theory	Tutorial	Total
EEC403	Electrical Machine–II (abbreviated as EMC-II)	4	-	4	-	4

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs)		
		Test 1	Test 2	Avg				
EEC403	Electrical Machine-II	20	20	20	80	3	-	100

Course Objectives	• To impart the knowledge of working principle, operations, performance and applications of single phase and three phase Transformers. • To understand the design of transformer with its cooling system. • To understand the performance parameters of transformers
Course Outcomes	Students will be able • To illustrate the working principle of single phase and three phase transformer • To illustrate the working principle of auto-transformer • To analyse various type of connections of three phase transformer. • To analyse performance of transformer under various operating conditions • To illustrate various design aspects of transformer. • To analyse the characteristics of CT and VT.

Module	Contents	Hours
1	**Single phase Transformer :-** Review of EMF equation, Equivalent Circuit, Phasor diagram, voltage regulation, Losses and Efficiency. Condition for Maximum Efficiency, All day Efficiency, Separation of Hysteresis and Eddy current losses. Parallel Operation: No load Operation, On load Operation: - Equal Voltage Operation and Unequal Voltage Operation, Testing of Transformer: - Polarity Test, OC and SC test, Sumpner's Test, Impulse test	10
2	**Autotransformer:-** Working, Advantages of Autotransformer over Two winding Transformer, Disadvantages. Introduction to High Frequency Transformer, Pulse Transformer, Isolation Transformer and its applications.	04
3	**Three Phase Transformers-** Construction and parts of transformer (design approach), Three phase transformer connections and phasor	10

LIBRARY Pillai HOC College of Engineering & Technology

	groups. Parallel operation, Excitation Phenomenon in transformers, Harmonics in three phase transformers, Suppression of harmonics, Oscillating neutral phenomenon, Switching in transient phenomenon, Open delta or V- connection, Three phase to two phase conversion (Scott connection).	
4	**Introduction to machine design**, Magnetic, Electrical, Conducting and Insulating materials used in machines. **Design of Single phase and Three phase transformers:-** Output equation, Main Dimensions, Specific electric and magnetic loadings, Design of core, Selection of the type of winding, Design of LV and HV windings, Design of insulation.	12
5	**Performance measurement of Transformers** Resistance and leakage reactance of the winding, Mechanical forces, No load current; Cooling of transformers – design of cooling tank and tubes. Relevant IS standards.	08
6	**Current Transformers** - Introduction, Terms and Definitions, Accuracy class, Burden on CT, Vector diagram of CT **Voltage Transformers** - Introduction, Theory of VT, Specifications for VT, Terms & definitions, Accuracy classes & uses, Burdens on VT, Connection of VTs	04

Books Recommended:

Text Books:

1. Bimbhra P. S., Electric Machinery , Khanna Publisher,
2. Bimbhra P. S., Generalized Machine Theory, Khanna Publisher,
3. E. G. Janardanan, Special Electrical Machines, PHI
4. V. K. Mehta, Principles of Electrical Machines, S Chand Publication
5. Switchgear & Protection by Sunil.S.Rao, Khanna Publications
6. A. K. Sawhney, "Electrical Machine Design", Dhanpat Rai & Co
7. M. V. Deshpande, "Design and Testing of Electrical Machines", PHI Learning

Reference Books:

1. M.G. Say and E. O. Taylor, *Direct current machines*, Pitman publication
2. Ashfaq Husain, *Electric Machines*, Dhanpat Rai and co. publications
3. Vedam Subramanyam, *Electrical Drive-concept and applications*, TMH Publication
4. A. E. Fitzgerald, Kingsly, Stephen., *Electric Machinery,* Tata McGraw Hill

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project

MAHATMA EDUCATION SOCIETY'S LIBRARY Pillai HOC College of Engineering & Technology

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

LIBRARY
TOC College of Engineering & Technology

University of Mumbai						
Course code	**Course Name**	**Teaching scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC404	**Electromagnetic Fields and Waves (Abbreviated as EFW)**	**3**	**1**	**3**	**1**	**4**

Course Code	Course Name	Examination Scheme						
		Theory					Term work	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (Hrs)		
		Test 1	Test 2	Avg				
EEC404	Electromagnetic Fields and Waves	20	20	20	80	03	25	125

Course Objectives	• To impart the knowledge of electro-physics. • Expose students Electric and magnetic field and their application in electrical engineering
Course Outcomes	Students will be able • To apply knowledge of mathematics and physics in electrical engineering field. • To analyse electrostatic and static magnetic fields. • To analyse the effect of material medium on electric and magnetic fields. • To analyse and formulate time varying electric and magnetic fields. • To analyse wave generation and its propagation in different media. • To analyse static magnetic field and electrostatic field distribution using software tool.

Module	Contents	Hours
1	**Vector Basics:** Concept of Scalar and Vector, Co-ordinate System: Rectangular, Cylindrical and Spherical Co-ordinate System, Co-ordinate and vector transformation, (Numerical on line, Surface and Volume Integrals)	04
2	**Static Electric Fields:** Coulomb's Law in Vector Form, Electric Field Intensity, Definition, Principle of Superposition, Electric Field due to point charges, Electric Field due to line charge (one and two conductor transmission lines), Electric Field due to an infinite uniformly charged sheet, Definition and physical interpretation of gradient, Electric scalar potential, Relationship	08

MAHATMA EDUCATION SOCIETY'S LIBRARY College of Engineering & Technology

	between potential and electric field and its application on Surface voltage gradient on conductor, Potential due to electrical dipole and flux lines, Electric Flux Density, Gauss Law, Definition and physical Significance of Divergence, Divergence theorem	
3	**Static Magnetic Fields:** The Biot-Savart's Law in vector form, Magnetic Field intensity due to a finite and infinite wire carrying a current I, Magnetic field intensity on the axis of a circular loop carrying a current I, Ampere's circuital law and its application on A solid cylindrical conductor and Infinitely long co-axial transmission line, Magnetic flux density, Definition and physical Interpretation of Curl, The Lorentz force equation for a moving charge and its applications on Force on a wire carrying a current I placed in a magnetic field, Torque on a loop carrying a current I, Magnetic moment, Magnetic Vector Potential.	08
4	**Electric and Magnetic Fields in Materials:** Poisson's and Laplace's equation and its application on Estimation and control of electric stress, control of stress at an electrode edge, Electric Polarization, Definition of Capacitance, Capacitance of two parallel plate, Co-axial, Spherical and Capacitance of two conductor of a single phase line, Electrostatic energy and energy density, Boundary conditions for electric and magnetic field, Electric current, Current density, Point form of ohm's law, Continuity equation for current, Definition of Inductance, Inductance of loops and solenoids, Flux linkage within and outside the conductor producing the flux, Energy density in magnetic fields.	08
5	**Time varying Electric and Magnetic Fields:** Faraday's law, Maxwell's Second Equation in integral form from Faraday's Law, Equation expressed in point form, Displacement current, Ampere's circuital law in integral form, Modified form of Ampere's circuital law as Maxwell's first equation in integral form, Equation expressed in point form, Maxwell's four equations in integral form and differential form.	04
6	**Wave theory:** Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in phasor form, Wave equation in phasor form, Plane waves in free space and in a homogenous material, Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect.	04

LIBRARY

Books Recommended:

Text books:

1. W. Hayt., "Engineering electromagnetic", McGraw Hill, 4th edition, 1987.
2. Edminister, "Schaum's series in electromagnetic" McGraw Hill publications, 3rd edition, 1986.
3. N. Narayan Rao, " Elements of Electromagnetic", PHI publication, 4th edition, 2001.
4. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Prentice Hall of India 2nd edition 2003. (Unit IV, V). McGraw-Hill, 9th reprint
5. G.S.N. Raju, " Electromagnetic Field Theory and Transmission Lines" Pearson publications, fifteenth impression,2013.
6. S. K. Singh.,"Fundamentals of High Voltage Engineering", Dhanpat Rai & Co. First edition,2014.
7. Dr. B.R. Gupta.,"Power System Analysis and Design", S. Chand, First edition,1998.
8. John D. Kraus & Keith R. Carver "Electromagnetics", McGraw-Hill Inc. 1973.

Reference books:

1. Fenmann, "Lectures on physics", Vol – 2, Addition Wesley, 1965
2. S. seely, "Introduction to electromagnetic fields", McGraw Hill, 1958.
3. David K. cheng, "Field and electromagnetic", Addison Wesley, 2nd edition, 1999.
4. Corson and lerrain, "Electromagnetic", CBS publications, 2nd edition, 1986.
5. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics" John Wiley & Sons (3rd edition 2003)
6. M.N.O.Sadiku: "Elements of Engineering Electromagnetics" Oxford University Press, Third edition.
7. David K.Cherp: "Field and Wave Electromagnetics - Second Edition-Pearson Edition.
8. David J.Grithiths: "Introduction to Electrodynamics- III Edition-PHI
9. John Reitz, Frederick Milford, Robert Christy, "Foundations of Electromagnetic Theory" Pearson publications, fourth impression,2013.

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Term work:

Term work consists of minimum eight tutorials (at least one on each module) and assignments (min. 2). The distribution of the term work shall be as follows:

Tutorials :15 marks
Assignments :05 marks
Attendance (Theory and Tutorial) :05 marks

BAHTMA EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

The final certification and acceptance of term-work ensures the minimum passing in the term-work.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S Pillai's HOC College of Engineering & Technology LIBRARY

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Tutorial**	**Theory**	**Tutorial**	**Total**
EEC405	**Analog and Digital Integrated Circuits (abbreviated as ADIC)**	**3**	**-**	**3**	**-**	**3**

Course Code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam. Duration (in Hrs)		
		Test 1	Test 2	Avg				
EEC405	Analog and Digital Integrated Circuits	20	20	20	80	3	-	100

Course Objectives	• To introduce the basic building blocks, theory and applications of linear integrated circuits. • To develop ability among students for problem formulation, system design and solving skills
Course Outcomes	Students will be able • To illustrate various performance parameters and characteristics of operational amplifier. • To illustrate various linear and non-linear application of operational amplifiers. • To design and analyse linear voltage regulators and multivibrators. • To do various conversion of number systems and illustrate logic families. • To build, design and analyse combinational circuits. • To build, design and analyse sequential circuits.

Module	Contents	Hours
1	**Operational Amplifiers: Fundamentals** Introduction to Differential amplifier, Block diagram of Op-amp Basics of an Op-amp, Op-amp parameters, Frequency response	03
2	**Application of Operational Amplifiers** Voltage follower, design of inverting and non- inverting amp, adder, subtractor, integrator and differentiator, V to I and I to V converter, Schmitt trigger, sample and hold circuits, active filters: first order LPF, Instrumentation amplifier (3 Op-amp) with applications, Optical isolation amplifier	08

MAHATMA EDUCATION SOCIETY'S Pillai HOC College of Engineering & Technology LIBRARY

3	**Linear Voltage Regulators –** IC -78xx, 79xx, LM 317. Design of adjustable voltage source using IC- LM317, Low Dropout (LDO) voltage regulator **IC-555-** Functional block diagram, Applications of IC 555, Design of Multivibrator (Monostable and Astable)	06
4	**Logic families -** Review of Number formats: Binary, hexadecimal, BCD and their basic math operations (addition and subtraction) Introduction to Logic gates and Boolean Algebra. Specifications of Digital IC, Logic Families: TTL,CMOS logic families, Comparison of TTL and CMOS, Interfacing of TTL and CMOS	06
5	**Combinational Logic Circuit -** K-Maps and their use in specifying Boolean expressions upto 4 variables, Minterm, Maxterm, SOP and POS implementation Implementing logic function using universal gates, Binary Arithmetic circuits: Adders, Subtractors (Half and Full), Multiplier, 2 bit comparators, Designing code converter circuit - binary to gray, Gray to Binary, Multiplexer (ULM), De- multiplexers.	08
6	**Sequential Logic Circuits -** Comparison of combinational & sequential circuit **Flip-flops -** SR, T, D, JK, Master Slave JK, Converting one flip-flop to another, Use of debounce switch **Counters-** Modulus of counter, Design of Synchronous, Asynchronous counters, Ripple counters, Up/Down Counter, Ring counter, **Shift Registers –** Right and left shift registers	05

Books Recommended:

Text Books:

1. Gayakwad Ramakant A, Op-amps and Linear Integrated Circuits, Prentice Hall PTR,
2. Boatkar K. R., "Integrated Circuits", Khanna Publication.
3. D. Roy Choudhury, Shali B Jain, "Linear Integrated Circuits" New Age International Publication.
4. Millman and Halkias, '*Integrated Electronics*', Tata McGraw Hill,
5. A. Anand Kumar, *"Fundamentals of Digital Circuits"*, PHI-2009
6. Jain R.P., *"Modern Digitals Electronics*", Tata McGraw Hill, 1984.
7. Roger L. Tokheim, "Digital Electronics", Tata McGraw Hill

Reference Books:

1. Design with OPAMP analog Ics by Sergio Franco. McGraw Hill 1998 2nd edition.
2. Boylestad Robert and Nashelsky Louis - '*Electronic Devices and Circuits*', Prentice-Hall of India,
3. Newman D.A., '*Electronic Circuit Analysis and Design'*, McGraw Hill International.

LIBRARY

4. David Bell, *Electronic Devices and Circuits*, 5e Oxford University Press
5. George Clayton, Steve Winder, *'Operational Amplifiers'*, Newnes
6. Alan b. Marcovitz, "*Introduction to logic Design*", McGraw Hill International 2002.
7. Malvino & Leach, *"Digital principal and Application"*, Tata McGraw Hill, 1991.
8. Bignell James& Donovan Robert "*Digital Electronics*", Delmar, Thomas Learning, 2001.
9. Jog N.K. *'Logic Circuits"*, 2nd Edition, Naidu Publishers & Printers Pvt. Ltd 1998.
10. Paul M. Chirlian, *"Analysis and Design of Integrated Electronic Circuits"*, 2nd Edition, John Wiley and Sons
11. Morris M. Mano. "*Digital Design*", Prentice Hall International – 1984.
12. Donald D. Givone, "Digital Priciples and Designs" Tata McGraw Hill

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

EDUCATION SOCIETY'S LIBRARY College of Engineering & Technology

University of Mumbai						
Course Code	Course Name	Teaching Scheme (Contact Hours)		Credits Assigned		
		Theory	Tutorial	Theory	Tutorial	Total
EEC406	Electrical Network (abbreviated as EN)	3	1	3	1	4

Course code	Course Name	Examination Scheme						
		Theory					Term Work	Total
		Internal Assessment			End Sem. Exam	Exam Duration (Hrs)		
		Test 1	Test 2	Avg				
EEC406	Electrical Network	20	20	20	80	3	25	125

Course Objectives	• To impart the knowledge of various fundamental techniques for analysis of electrical network from application point of view. • To mold creative engineers needed in education and industrial development along with problem solving skills.
Course Outcomes	Students are able • To analyze electrical network using different Network theorems. • To analyze electrical network using Graph theory. • To analyze the effect of switching conditions on Electrical networks using Differential equations. • To analyze the effect of switching conditions on Electrical networks using Laplace Transform. • To develop transfer function model of system using two port network parameters. • To analyze time domain behavior from pole zero plot

Module	Contents	Hours
1	**Solution of Network:** **with DC Dependent Sources:** Mesh analysis, Super mesh analysis, Nodal analysis, Super node analysis, Source transformation and Source shifting. Superposition theorem, Thevenin's theorems and Norton's theorem and Maximum power transfer theorem. **with AC Sources:** Magnetic coupling, Mesh analysis, Nodal analysis, Superposition theorem, Thevenin's theorems, Norton's theorem, Maximum power transfer theorem and Reciprocity theorem	10
2	**Graph Theory and Network Topology:** Introduction, Graph of network, Tree, Co-tree, Loop incidence matrix,	05

M.H. KOC College of Engineering & Technology LIBRARY

	Cut set matrix, Tie set matrix and Loop current matrix, Number of possible tree of a graph, Analysis of network equilibrium equation and Principle of duality.	
3	**First Order and Second Order Differential Equations:** Behaviors of network elements under switching condition and their representation, Solution of initial and final condition in RL, RC and RLC networks for AC and DC sources.	05
4	**The Laplace Transform:** The Laplace transform and its application to network analysis, transient and steady state response to step, ramp and impulse signals.	05
5	**Two port parameters:** Open circuit, short circuit, transmission and hybrid Parameters, relationships between parameter sets, reciprocity and symmetry conditions, parallel connection of two port networks	05
6	**Network Functions; Poles and Zeros:** Network functions for one port and two port networks, Driving point and transfer functions, ladder network, General network, poles and zeros of network functions, restrictions on Pole and zero locations for driving point functions and Transfer functions, time domain behavior from pole - zero plot.	06

Note: Numerical should be covered in Tutorials.

Books Recommended:

Text Books:

1. W H Hayt, S M Durbin, J E Kemmerly, '*Engineering Circuit Analysis'*, 7th Edition Tata McGraw-Hill Education.
2. M. E. Van Valkenburg, '*Network Analysis'*, 3rd Edition, PHI Learning.
3. D. Roy Choudhury, '*Networks and Systems'*, 2nd Edition, New Age International.
4. M. E. Van Valkenburg, '*Linear Circuits'*, Prentice Hall.

Reference Books:

1. F. F. Kuo,' *Network Analysis and synthesis'*, John Wiley and sons.
2. N Balabanian and T.A. Bickart, '*Linear Network Theory: Analysis, Properties, Design and Synthesis*', Matrix Publishers, Inc.
3. C. L.Wadhwa, '*Network Analysis and synthesis*', New Age international.
4. B. Somanathan Nair, "Network Analysis and Synthesis", Elsevier Publications

Assessment:

Internal Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

Term work:

Term work consists of minimum eight tutorials (at least one on each module) and assignments (min. 2). The distribution of the term work shall be as follows:

MAHATMA EDUCATION SOCIETY LIBRARY Pillai's HOC College of Engineering & Technology

Tutorials :15 marks
Assignments :05 marks
Attendance (Theory and Tutorial) :05 marks
The final certification and acceptance of term-work ensures the minimum passing in the term-work.

Theory Examination:

1. Question paper will comprise of 6 questions, each carrying 20 marks.
2. Total four questions need to be solved.
3: Q.1 will be compulsory, based on entire syllabus wherein sub questions of 2 to 5 marks will be asked.
4: Remaining question will be randomly selected from all the modules.

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL401	**Simulation Lab-I (abbreviated Sim Lab-I)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL401	Simulation Lab-I	-	-	-	-	25	-	25	50

Course Objectives	• To understand basic block sets of different simulation platform used in electrical system design. • To understand coding in different programming software's used in electrical system design
Course Outcomes	Students are able • To simulates electrical circuits for their performance analysis. • To develop algorithms for electrical circuits for their performance analysis. • To simulates electronic circuits for their performance analysis. • To develop algorithms for electronic circuits for their performance analysis.

Suggested List of Laboratory Experiment:

1. Introduction to basic block sets of simulation platform.
2. Simulation of single phase bridge rectifier without filter
3. Simulation of single phase bridge rectifier with filter
4. Simulation of UJT as a relaxation oscillator
5. Algorithm on matrix operations
6. Simulation for OC and SC test of single phase transformer
7. Simulation of transmission line model
8. Algorithms to determine transmission line performance and parameters
9. Algorithm for generation of standard test signals
10. Simulation of differential equations
11. Simulation to verify different network theorems with dependent and independent sources
12. Simulation of DC motor performance characteristics
13. Simulation / Algorithms to draw the pole zero plot of electrical network
14. Simulation / Algorithms to draw the response of electrical network for standard test signals.

Any other simulations / algorithms based on third and fourth semester syllabus, which will help students to understand topic / concept.

MAHATMA EDUCATION SOCIETY'S LIBRARY Engineering & Technology

Term work:

Term work consists of minimum 8 simulation / algorithms (at least one on each domain). The distribution of the term work shall be as follows:

Simulation / Algorithm :20 marks

Attendance :05 marks

The final certification and acceptance of term-work ensures the minimum passing in the term-work.

Practical/Oral Examination:

Practical/Oral examination will be based on entire syllabus.

MAHAMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL402	**Electrical Machine Lab-II (abbreviated EMC Lab-II)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL402	Electrical Machine Lab - II	-	-	-	-	25	25	-	50

Course Objectives	• To impart the knowledge of working principle, operations, performance and applications of single phase and three phase Transformers. • To understand the performance parameters of transformers
Course Outcomes	Students will be able • To demonstrate the working principle of single phase and three phase transformer • To demonstrate the working principle of auto-transformer • To analyse various type of connections of three phase transformer. • To analyse performance of transformer under various operating conditions • To analyse the characteristics of CT and VT.

Syllabus: Same as that of Course EEC403 Electrical Machine - II

Suggested List of Laboratory Experiment:

1. O.C & S.C. Test on 1Φ Transformer
2. Sumpner's Test on 1Φ Transformer
3. Separation of iron loss into hysteresis and eddy current loss components in a1Φ Transformer
4. Load Test on 1Φ Transformer
5. Open circuit & Short circuit test on three phase transformer
6. Parallel operation of transformers
7. Scott connection of transformer
8. Open Delta connection of transformer

Any other experiment based on syllabus which will help students to understand topic/concept.

MAHARASHTRA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

Term work:

Term work shall consist of minimum 6 experiments. The distribution of marks shall be as follows:

Experiments Performance	:10 marks
Journal	:10 marks
Attendance (Theory and Practical)	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Practical/Oral Examination:

Practical/Oral examination will be based on entire syllabus.

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL403	**Electronics Lab-II (abbreviated EL Lab-II)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL403	Electronics Lab-II	-	-	-	-	25	25	-	50

Course Objectives	• To introduce the basic building blocks, theory and applications of linear integrated circuits. • To develop ability among students for problem formulation, system design and solving skills
Course Outcomes	Students will be able • To demonstrate various performance parameters and characteristics of operational amplifier. • To demonstrate various linear and non-linear application of operational amplifiers. • To build, design, and analyse linear voltage regulators and multi vibrators.. • To build, design and analyse combinational circuits. • To build, design and analyse sequential circuits.

Syllabus: Same as that of Course EEC405 Analog and Digital Integrated Circuits.

Suggested List of Laboratory Experiments:

1. Linear applications of op-amp
2. Non linear applications of op-amp
3. Active filters
4. Design and implementation of variable voltage regulator using IC 317
5. Design and implementation of astable multivibrator
6. Design and implementation of monostable multivibrator
7. Design and implementation of VCO.
8. Implementing a Binary to Gray, gray to binary or Binary to XS3 code converter using gate ICs.
9. Constructing flip-flops like SR, D, JK and T using all NAND gates and a debounce

LIBRARY

switch.

10. Designing a mod N counter where N <14 using J K flip-flops and D flip-flops.
11. Design of a ripple counter
12. Design two bit comparator using gate ICs.
13. Building of a ring counter and twisted ring counter using D flip-flop ICs.
14. Any one of the following
    (i) Full Adder using Gates and using Decoder or a Multiplexer.
    (ii) Using a shift register as a sequence generator.

Any other experiment based on syllabus which will help students to understand topic/concept.

Term work:

Term work shall consist of minimum 10 experiments. The distribution of marks for term work shall be as follows:

Experiments Performance	:10 marks
Journal	:10 marks
Attendance (Theory and Practical)	:05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Practical/Oral Examination:

Practical/Oral examination will be based on entire syllabus.

LIBRARY Fr. Agnel's MGC. College of Engineering & Technology

University of Mumbai						
Course Code	**Course Name**	**Teaching Scheme (Contact Hours)**		**Credits Assigned**		
		Theory	**Practical**	**Theory**	**Practical**	**Total**
EEL404	**Electrical Workshop (abbreviated EW/S)**	**-**	**2**	**-**	**1**	**1**

Course Code	Course Name	Examination Scheme							Total
		Theory				Practical			
		Internal Assessment			End Sem. Exam	Term Work	Pract. and Oral	Oral	
		Test 1	Test 2	Avg					
EEL404	Electrical Workshop	-	-	-	-	25	-	25	50

Course Objectives	• To introduce the basic laboratory instruments used for measurement purpose. • To develop the ability to handle electrical equipment.
Course Outcomes	Students will be able • To demonstrate various electrical and electronic measuring equipment's. • To identify various electrical and power electronic components. • To repair and do maintenance of households appliances. • To identify and use different low voltage protective switchgears. • To identify and use different wiring accessories and tools.

Syllabus:-

Module	Contents	Hours
1	**Introduction of lab equipment's and electrical elements:** Introduction to different equipment in the lab (multi-meter, CRO, DSO, power supplies, function generators); Resistors, presets, potentiometers, inductors (iron core and ferrite core), capacitors of different ratings. Electromagnetic Relays, MOVs,	03
2	**Introduction to different electronic components:** different ratings, packages, terminals, sizes and shapes, testing methods of diodes (rectifier, ultrafast, schotkey, power, zener, LED), transistors(BJT), SCRs, GTOs, MOSFETs, IGBTs, DIACs, TRIACs, intelligent power modules (IPM) (Minimum Three) Different PCB connectors, Terminal, Terminal Blocks; Transformers used for electronic circuits (pulse, high frequency)	03

EDUCATION SOCIETY'S LIBRARY Pillai's HOC College of Engineering & Technology

3	**Commonly used ICs:** Data sheet reading of commonly used ICs (buffers,opto-couplers, gate drivers, PWM ICs, Real time clock ICs, PLL ICs, seven segment display and driver) (Minimum Three)	04
4	**Hardware implementation of Electronics circuits:** Soldering techniques and equipments, PCB Layout (artwork) design using software and Fabrication ~~itching~~ process. Testing and debugging process of assembled circuits	06
5	**Residential/ Industrial Wiring:** Wiring materials, selection of wire, different switching and protection devices (MCBs/ Fuses/Relays), Cables and cable management Estimation and costing of residential wiring (Simple numerical on wiring of single room), connection of energy meter and distribution board, wiring standards (IS-732, section 4)	04
6	**Repair of house hold appliances and machines:** Testing, fault finding, Dismantling, assembling and testing after repairs of house hold appliances like fan and regulator, heater, geyser, mixer, **washing machine**, microwave oven etc.(minimum Two) Troubleshooting charts for 1 ph and 3ph transformers and motors (Minimum one transformer and one motor)	04

Books Recommended:

:

1. J. B. Gupta Electrical Installation Estimating & costing
2. Raina Bhattachraya Estimating dsign & costing
3. Allasappan & Ekambarm Estimating design & costing
4. S L Uppal Estimating & costing
5. Surjit Singh Electrical Estimating & costing
6. K B. Bhatia: Electrical Appliances

Suggested List of Laboratory Experiments:

1. Study of different symbols and tools used in Electrical Engineering
2. Identify values of different resistors and capacitor using color code and DMM
3. Identify different types of cables/wires, switches and their uses.
4. Identify different types of fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
5. Wiring of simple light circuit for controlling light/fan point (PVC conduit wiring and wiring accessories)
6. Wiring of fluorescent lamps and light sockets (6 A).
7. Wiring of Power circuit for controlling power device (16A socket)
8. Design of Staircase wiring / Go-down wiring / Tunnel wiring

LIBRARY Pillai's HOC College of Engineering & Technology

9. Demonstration and measurement of power/energy consumption and repair maintenance of electric iron/mixer grinder/ washing machine/refrigerator/ air conditioner/water heater/geyser/single phase pump/exhaust fan.
10. Verifying the fusing time of rewireable fuses.
11. To identify terminology of various semiconductor devices.

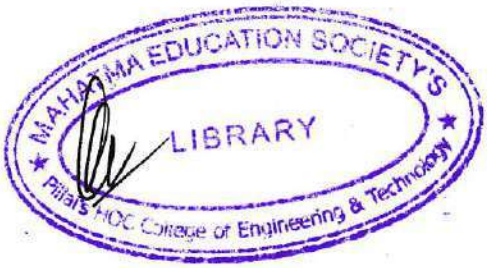
Any other experiment based on syllabus which will help students to understand topic/concept.

Term Work:
Term work shall consist of minimum 8 experiments. The distribution of marks for term work shall be as follows:

Laboratory Performance	: 10 marks
Journal	: 10 marks
Attendance	: 05 marks

The final certification and acceptance of term work ensures the minimum passing in the term work.

Oral Examination:
Oral examination will be based on entire syllabus.



Program Structure for
TE Electrical Engineering
University of Mumbai
(With Effect from 2018-19)

Scheme for Semester V

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC501	Power System - II	4	-	1	4	-	1	5
EEC502	Electrical Machines - III	4	-	-	4	-	-	4
EEC503	Control System - I	4	-	-	4	-	-	4
EEC504	Power Electronics	4	-	-	4	-	-	4
EEDLO501X	Department Level Optional Course-I	3	-	1	3	-	1	4
EEL501	Business Communication and Ethics	-	4**	-	-	2	-	2
EEL502	Control System Lab	-	2	-	-	1	-	1
EEL503	Electrical Machines Lab - III	-	2	-	-	1	-	1
EEL504	Power Electronics Lab	-	2	-	-	1	-	1
Total		**19**	**10**	**2**	**19**	**5**	**2**	**26**

**** Out of four hours, 2 hours theory shall be taught to entire class and 2 hours practical in batches**

LIBRARY
Pillai's HOC College of Engineering & Technology

Examination Scheme for Semester V

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC501	Power System - II	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC502	Electrical Machines - III	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC503	Control System - I	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC504	Power Electronics	80	32	20	8	-	-	-	-	-	-	-	-	100
EEDLO 501X	Department Level Optional Course-I	80	32	20	8	25	10	-	-	-	-	-	-	125
EEL501	Business Communication and Ethics	-	-	-	-	50	20	-	-	-	-	-	-	50
EEL502	Control System Lab	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL503	Electrical Machines Lab - III	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL504	Power Electronics Lab	-	-	-	-	25	10	-	-	-	-	25	10	50
Total		**400**	**-**	**100**	**-**	**175**	**-**	**-**	**-**	**25**	**-**	**50**	**-**	**750**

MAHATMA EDUCATION SOCIETY'S
LIBRARY

Program Structure for
TE Electrical Engineering
University of Mumbai
(With Effect from 2018-19)

Scheme for Semester VI

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC601	Protection and Switchgear Engineering	3	-	-	3	-	-	3
EEC602	Electrical Machines.- IV	4	-	-	4	-	-	4
EEC603	Signal processing	3	-	1	3	-	1	4
EEC604	Microcontroller and its Applications	4	-	-	4	-	-	4
EEC605	Control System - II	4	-	-	4	-	-	4
EEDLO602X	Department Level Optional Course-II	3	-	1	3	-	1	4
EEL601	Electrical Protection Lab	-	2	-	-	1	-	1
EEL602	Electrical Machines Lab - IV	-	2	-	-	1	-	1
EEL603	Microcontroller Lab	-	2	-	-	1	-	1
EEL604	Simulation Lab – II	-	2	-	-	1	-	1
Total		**21**	**8**	**2**	**21**	**4**	**2**	**27**

LIBRARY
Pillai's HOC College of Engineering & Technology

Examination Scheme for Semester VI

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC601	Protection and Switchgear Engineering	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC602	Electrical Machines - IV	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC603	Signal processing	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC604	Microcontroller and its Applications	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC605	Control System - II	80	32	20	8	-	-	-	-	-	-	-	-	100
EEDLO602X	Department Level Optional Course-II	80	32	20	8	25	10	-	-	-	-	-	-	125
EEL601	Electrical Protection Lab	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL602	Electrical Machines Lab - IV	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL603	Microcontroller Lab	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL604	Simulation Lab – II	-	-	-	-	25	10	-	-	25	10	-	-	50
Total		**480**	**-**	**120**	**-**	**150**	**-**	**-**	**-**	**50**	**-**	**50**	**-**	**850**

MARATHA EDUCATION SOCIETY'S
LIBRARY

Program Structure for
BE Electrical Engineering
University of Mumbai
(With Effect from 2019-20)

Scheme for Semester VII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC701	Power System - III	4	-	1	4	-	1	5
EEC702	Drives and Control	4	-	-	4	-	-	4
EEC703	High Voltage Direct Current Transmission	4	-	-	4	-	-	4
EEDLO703X	Department Level Optional Course-III	3	-	1	3	-	1	4
ILO701X	Institute Level Optional Course-I	3	-	-	3	-	-	3
EEL701	Simulation Lab - III	-	2	-	-	1	-	1
EEL702	Drives and Control Lab	-	2	-	-	1	-	1
EEL703	Project-I	-	6	-	-	3	-	3
Total		**18**	**10**	**2**	**18**	**5**	**2**	**25**

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

Examination Scheme for Semester VII

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC701	Power System - III	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC702	Drives and Control	80	32	20	8	-	-	-	-	-	-	-	-	100
EEC703	High Voltage Direct Current Transmission	80	32	20	8	-	-	-	-	-	-	-	-	100
EEDLO 703X	Department Level Optional Course-III	80	32	20	8	25	10	-	-	-	-	-	-	125
ILO701 X	Institute Level Optional Course-I	80	32	20	8	-	-	-	-	-	-	-	-	100
EEL701	Simulation Lab - III	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL702	Drives and Control Lab	-	-	-	-	25	10	-	-	-	-	25	10	50
EEL703	Project-I	-	-	-	-	25	10	-	-	25	10	-	-	50
Total		**400**	**-**	**100**	**-**	**125**	**-**	**-**	**-**	**50**	**-**	**25**	**-**	**700**

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Tech

Program Structure for
BE Electrical Engineering
University of Mumbai
(With Effect from 2019-20)

Scheme for Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
EEC801	Design, Management and Auditing of Electrical Systems	4	-	1	4	-	1	5
EEC802	Flexible AC Transmission System	4	-	-	4	-	-	4
EEDLO804X	Department Level Optional Course-IV	3	-	1	3	-	1	4
ILO802X	Institute Level Optional Course-II	3	-	-	3	-	-	3
EEL801	Simulation Lab - IV	-	2	-	-	1	-	1
EEL802	Electrical System Design Lab		2	-	-	1	-	1
EEL803	Project-II	-	12	-	-	6	-	6
Total		**14**	**16**	**2**	**14**	**8**	**2**	**24**

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology

Examination Scheme for Semester VIII

Course Code	Course Name	Examination Scheme												Total Marks
		Theory				Term Work		Practical		Oral		Pract./Oral		
		External (UA)		Internal (CA)										
		Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	
EEC801	Design, Management and Auditing of Electrical Systems	80	32	20	8	25	10	-	-	-	-	-	-	125
EEC802	Flexible AC Transmission System	80	32	20	8	-	-	-	-	-	-	-	-	100
EEDLO 804X	Department Level Optional Course-IV	80	32	20	8	25	10	-	-	-	-	-	-	125
ILO802 X	Institute Level Optional Course-II	80	32	20	8	-	-	-	-	-	-	-	-	100
EEL801	Simulation Lab - IV	-	-	-	-	25	10	-	-	25	10	-	-	50
EEL802	Electrical System Design Lab					25	10	-	-	25	10	-	-	50
EEL803	Project-II	-	-	-	-	50	20	-	-	50	20	-	-	100
Total		**320**	-	**80**	-	**150**	-	-	-	**100**	-	-	-	**650**

M.H. SABOO SIDDIK EDUCATION SOCIETY'S
LIBRARY
Engineering & Technology

List of Department Level Optional Courses

Course Code	Department Level Optional Course - I
EEDLO5011	Communication Engineering
EEDLO5012	Renewable Energy and Energy Storage
EEDLO5013	Utilization of Electrical Energy

Course Code	Department Level Optional Course - II
EEDLO6021	Digital Communication Engineering
EEDLO6022	Micro-grid
EEDLO6023	Advanced Power Electronics

Course Code	Department Level Optional Course - III
EEDLO7031	High Voltage Engineering
EEDLO7032	Electric Vehicle Technology
EEDLO7033	Industrial Controller
EEDLO7034	Power Quality

Course Code	Department Level Optional Course - IV
EEDLO8041	Illumination Engineering
EEDLO8042	Smart Grid
EEDLO8043	Power System Modeling and Control
EEDLO8044	Power System Planning and Reliability

List of Institute Level Optional Courses

Course Code	Institute Level Optional Course - I
ILO7011	Product Lifecycle Management
ILO7012	Reliability Engineering
ILO7013	Management Information System
ILO7014	Design of Experiments
ILO7015	Operation Research
ILO7016	Cyber Security and Laws
ILO7017	Disaster Management and Mitigation Measures
ILO7018	Energy Audit and Management
ILO7019	Development Engineering

Course Code	Institute Level Optional Course - II
ILO8021	Project Management
ILO8022	Finance Management
ILO8023	Entrepreneurship Development and Management
ILO8024	Human Resource Management
ILO8025	Professional Ethics and Corporate Social Responsibility (CSR)
ILO8026	Research Methodology
ILO8027	IPR and Patenting
ILO8028	Digital Business Management
ILO8029	Environmental Management

MAHATMA EDUCATION SOCIETY'S
LIBRARY
Pillai's HOC College of Engineering & Technology