KAMARAJ®
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near VIRUDHUNAGAR).

MINUTES OF THE MEETING OF THE 3rd BOARD OF STUDIES (EEE BOARD) MEETING HELD ON 13-11-2021 AT 10:00 AM IN ONLINE TOWARDS THE APPROVAL OF B.E., ELECTRICAL AND ELECTRONICS ENGINEERING CURRICULUM AND SYLLABUS FOR 5TH AND 6TH SEMESTER INCLUDING PROFESSIONAL ELECTIVES, OPEN ELECTIVES, ONLINE COURSES, VALUE ADDED COURSES, AUDIT COURSES, SKILL DEVELOPMENT COURSES AND THE AMENDMENTS IN 2nd YEAR SYLLABUS. DISCUSSION AND APPROVAL OF IMPLEMENTING FIRST YEAR COMMON CURRICULUM TO 2021-22 BATCH STUDENTS AND CURRICULUM OF PROPOSED NEW UG PROGRAMME B.E., ELECTRICAL AND COMPUTER ENGINEERING.

Platform: Microsoft Teams

Meeting Link:

https://teams.microsoft.com/l/meetup-join/19%3ameeting_MmQxZTYwNzQtOWY3Ni00NzRhLThhY2YtZDcxNDM0YjMwNWFj%40thread.v2/0?context=%7b%22Tid%22%3a%222666d919-f1fc-4027-b9c5-212d4e95e68a%22%2c%22Oid%22%3a%22294bf351-fb1f-4f0c-b3c8-efb73114c4fe%22%7d

Item No: 003.01.00 – 003.03.00

Dr. D. Prince Winston, Professor and HoD (Department of Electrical and Electronics Engineering) welcomed all the members to the 3rd BoS meeting organized towards the approval of B.E., Electrical and Electronics Engineering

curriculum and syllabus for 5th and 6th semester including Professional Electives, Open Electives, Online Courses, Value Added Courses, Audit Courses, Skill Development Courses and the amendments in 2nd year syllabus. Discussion and approval of implementing first year common curriculum to 2021-22 batch students and curriculum of proposed new UG Programme B.E., Electrical and Computer Engineering.

He also informed that the 2nd BoS meeting was completed on 08-05-2021 and he presented the minutes of 2nd BoS meeting for approval. All the external and internal members approved the minutes of 2nd BoS meeting.

Item No: 003.04.01

Presentation of UG curriculum and syllabi of 5th and 6th semester:

Dr. J. Jeslin Drusila Nesamalar, Assistant Professor, Department of Electrical and Electronics Engineering gave a brief presentation about the entire curriculum of B.E., Electrical and Electronics Engineering. She also presented the detailed syllabus of 5th and 6th semester courses.

The following curriculum and syllabi for 5th and 6th semester was presented and suggestions were invited from the BoS members.

SEMESTER V

S. No.	Course Code	Course Name	Category	Contact Periods	Credits			
					L	T	P	C
Theory								
1.	EE1501	Power System Analysis	PC	3	3	0	0	3
2.	EE1571	Control Systems	PC	4	3	1	0	4
3.	EE1572	Microprocessors and Microcontrollers	PC	3	3	0	0	3
4.		Professional Elective I	PE	3	3	0	0	3
5.		Open Elective I	OE	3	3	0	0	3
6.		Audit Course II	AU	3	3	0	0	0
Practical								
7.	EE1511	Control and Instrumentation Laboratory	PC	4	0	0	4	2

S. No.	Course Code	Course Name	Category	Contact Periods	Credits			
					L	T	P	C
8.	EE1581	Microprocessors and Microcontrollers Laboratory	PC	4	0	0	4	2
9.	EE1521	Presentation Skills and Technical Seminar	EEC	2	0	0	2	1
			Total	**29**	**18**	**1**	**10**	**21**

SEMESTER VI

S. No.	Course Code	Course Name	Category	Contact Periods	Credits			
					L	T	P	C
Theory								
1.	EE1601	Power Electronics and Drives	PC	3	3	0	0	3
2.	EE1602	Protection and Switchgear	PC	3	3	0	0	3
3.	EE1603	Renewable Energy Systems	PC	3	3	0	0	3
4.	EE1671	Digital Signal Processing	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Online Course I*	OL	3	3	0	0	3
Practical								
7.	EE1611	Power Electronics and Drives Laboratory	PC	4	0	0	4	2
8.	EE1612	Renewable Energy Systems Laboratory	PC	4	0	0	4	2
9.	HS1621	Verbal Reasoning and Aptitude	EEC	2	0	0	2	1
			Total	**28**	**18**	**0**	**10**	**23**

EE1501 POWER SYSTEM ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To model the power system under steady state operating condition
- To apply numerical iterative techniques for load flow studies.
- To model and carry out short circuit studies on power system
- To model and analyze stability problems in power system

UNIT I INTRODUCTION TO POWER SYSTEM 9

Power scenario in India - Power system components (Synchronous generator,

Synchronous motor, Transmission line, off-nominal transformer & load) – Representation - Single line diagram - per unit quantities - p.u. impedance diagram and reactance diagram - Network graph, Bus incidence matrix, Primitive parameters- Formation of bus admittance matrix using Two rule method and Singular Transformation method.

UNIT II POWER FLOW ANALYSIS **9**

Significance of power flow analysis- Bus classification (PV, PQ and SB) - Power Flow equations in polar coordinates - Power flow solution using Gauss Seidel method - Handling of Voltage controlled buses - Power Flow Solution by Newton Raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS **9**

Importance of short circuit studies- Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem – Formation of Bus Impedance matrix using bus building algorithm (without mutual coupling) - Symmetrical fault analysis using bus impedance matrix - Current limiting reactors.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS **9**

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG faults - computation of post fault currents in symmetrical components and phasor domain.

UNIT V STABILITY ANALYSIS **9**

Importance of stability studies-Classification of power system stability – Rotor angle stability - Swing equation - Swing curve - Power-Angle equation - Equal area criterion - Critical clearing angle and time - Classical step-by-step solution of the swing equation – fourth order Runge Kutta method (Simple numerical problems).

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Model and develop the per unit equivalent circuit of power system network and to determine the various network matrices by suitable method.

CO2: Formulate the power flow problem and solve using numerical iterative methods

CO3: Solve the given power system network under symmetrical faults using appropriate technique

CO4: Determine the fault current and post fault voltage when subjected to unsymmetrical faults.

CO5: Classify power system stability and derive the swing equation for SMIB system and to assess the transient stability of given SMIB system by appropriate technique

TEXT BOOKS:

1. Stevenson Jr, W. and Grainger, J., 2015. *Power system analysis*. McGraw-Hill Education.
2. Kothari, D.P. and Nagrath, I.J., 2019. *Power System Engineering, 3e*. McGraw-Hill Education.

REFERENCES:

1. Saadat, H., 2015. 'Power System Analysis', Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. Pai, M.A. and Chatterjee, D., 2014. *Computer techniques in power system analysis*. McGraw-Hill Education (India).
3. Glover, J.D., Sarma, M.S. and Overbye, T., 2012. *Power system analysis & design, SI version*. Cengage Learning.
4. Gupta, B.R., 2008. *Power System*. S. Chand publishing.
5. Kundur, P., 2010. Power system stability. *Power system stability and control*, pp.7-10.

EE1571 CONTROL SYSTEMS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the basic control system components for the analysis of physical systems.
- To provide adequate knowledge on the time response analysis and steady state error analysis of linear systems.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency response analysis of linear systems.
- To introduce the concepts of stability analysis and design of various types of compensators.
- To introduce state variable representation of physical systems.

UNIT I SYSTEMS AND REPRESENTATION **12**

Basic elements in control systems: Open and closed loop systems – Mathematical Models – Differential Equations - Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs- Case Study: AC and DC servomotors

UNIT II TIME RESPONSE ANALYSIS **12**

Time response: Time domain specifications – Standard Test Signals – Time domain analysis of I and II order system – Error coefficients – Generalized error series – Steady state error – Root locus construction- Effect of addition of poles and Zeros - Effects of P, PI, PID modes of feedback control

UNIT III FREQUENCY RESPONSE ANALYSIS **12**

Frequency response: Bode plot – Polar plot – Determination of closed loop response from open loop response (M and N circles) - Correlation between frequency domain and time domain specifications

UNIT IV STABILITY AND COMPENSATOR DESIGN 12

Characteristic equation – Routh Hurwitz criterion – Nyquist stability criterion-Performance criteria –Effect of Lag, lead and lag-lead compensation on frequency response-Design of Lag, Lead and Lag Lead compensator using bode plots.

UNIT V STATE VARIABLE ANALYSIS 12

Concepts of state variables – State models for linear and time invariant Systems (Controllable, Observable and Jordan Models) – Equivalence between transfer function and state variable representations - Solution of state and output equation – Concepts of controllability and observability

TOTAL: 60 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to
CO1: Develop mathematical model for various physical systems.
CO2: Determine time-domain specifications of given linear system and discuss on applications of various types of conventional controllers (P, PI and PID)
CO3: Obtain the frequency response analysis of given linear system using bode and polar plot.
CO4: Analyze the stability of control system using suitable methods and design compensator s for the given specifications.
CO5: Frame various types of state space model for a system and obtains its solution.

TEXT BOOKS:

1. Nagrath, I.J., 2018. *Control systems engineering*. New Age International
2. Kuo, B.C., 2018. *Automatic control systems*. Wiley.

REFERENCES:

1. Gopal, M., 2012. *Control systems: principles and design*. Tata McGraw-Hill Education.
2. Ogata, K. and Yang, Y., 2002. *Modern control engineering* (Vol. 4). India: Prentice hall.
3. Dorf, R.C. and Bishop, R.H., 2011. *Modern control systems*. Pearson.
4. Dutton, K., 1997. *The art of control engineering*. Addison-Wesley Longman Publishing Co., Inc..
5. Houpis, C.H. and Sheldon, S.N., 2013. *Linear Control System Analysis and Design with MATLAB®*. CRC Press.
6. NPTEL Video Lecture Notes on "Control Engineering"

EE1572	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the programming concepts in 8085 processor
- To understand the features of 8051
- To deliver the introduction in PIC
- To study the interfacing of different sensors with Arduino

UNIT I: MICROPROCESSOR 8085 **12**

Pin out and Architecture of 8085-Instruction format- Classifications of Instructions- size, operations and addressing modes-Data transfer and manipulation instructions-Branching and Machine related instructions-Timing Diagram-Interfacing with 8255, 8254.

UNIT II: MICROCONTROLLER 8051 **10**

Hardware Architecture, pin outs of 8051- -RAM addressing- Ports in 8051- SFRs-Addressing mode- Instruction set- Stepper and Servo motor control

UNIT III: PIC MICROCONTROLLER **8**

CPU Architecture-Instruction set- Timers-UART-A/D Converter- PWM - Introduction to C compiler

UNIT IV: ARDUINO **8**

I/O Port Capability of Arduino UNO- Variables –Looping statement-Operators-Simple Programming

UNIT V: APPLICATIONS **7**

Temperature Monitoring- Distance Measurement- Obstacle detection- Stepper and servo motor control- GPS

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the learner will be able to:

CO1: Describe the architecture, different operations and interfacing concept of 8085

CO2: Understand the special features and programming concepts in 8051

CO3: Comprehend the architecture and functionality of PIC microcontroller

CO4: Grasp the basic knowledge in Arduino

CO5: Develop a high level programming knowledge in Arduino

TEXT BOOKS:

1. Ramesh Gaonkar 2013. *Microprocessor Architecture Programming and Applications with 8085*, Penram Intl. Publishing, 6th Edition.
2. Kenneth Ayala 2007. *The 8051 Microcontroller*, Cengage Learning Publications, 3rd Edition.

REFERENCE BOOKS:

1. Muhammad Ali Mazidi, Janice GillispieMazidi & RolinMcKinlay 2012. *The*

8051 Microcontroller and Embedded Systems using Assembly and C, Prentice Hall Publications, 2nd Edition.
2. Ray,A.K., & Bhurchandi , K.M., 2013. *Advanced Microprocessor and Peripherals*, Tata McGraw-Hill Publications, 3 rd Edition.
3. Sencer Yeralan& Helen Emery 2000. *Programming and interfacing the 8051 Microcontroller*, Addison-Wesley Publications, 1st Edition.
4. Massimo Banzi, 2014. *Getting Started with Arduino: The Open Source*, Shroff Publishers and Distributors pvt.ltd.
5. Simon monk, 2016. Programming Arduino: Getting Started with Sketches, Mc-Graw Hill Educations, second edition.

EE1511	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

To impart knowledge on the analysis and design of control system concepts along with basics of instrumentation.

LIST OF EXPERIMENTS

Control Systems

1. Estimate the effects of P, PI, PD and PID controllers on the Second-order linear system using suitable software package.
2. Perform stability analysis of linear systems using Bode, Root locus & Nyquist plots method using suitable software package.
3. Derive the mathematical modelling of a DC machine and Thermistor
4. Design of Lag, Lead and Lag-Lead Compensators using suitable software package.
5. DC Position Control Systems
6. AC Synchro: Transmitter- Receiver and Characteristics

Instrumentation

7. AC bridges (Anderson bridge) and (Schering bridge), DC bridges (Wheat stone bridge)
8. Study of Displacement Transducer – LVDT, Study of Pressure Transducer, Study of Flow sensor, Study of RDT
9. Calibration of Three Phase Energy meter by direct loading, Measurement of Three Phase power and power factor, Calibration of Single-Phase energy meter
10. Instrumentation Amplifier
11. D/A and A/D converters
12. Real time interfacing of Sensors with Microcontrollers

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of this course, students will be able to

CO1: Demonstrate the concepts of control theory to perform stability analysis on linear systems

CO2: Design simulation models for controllers/compensators for simple electrical applications.

CO3: Implement bridge circuits to measure various electrical quantities

CO4: Calibrate energy meter and perform signal conditioning of instruments

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
Control System		
1.	Digital storage Oscilloscope	1 No.
2.	Personal Computer with control system simulation packages (MATLAB)	10 Nos
3.	DC motor –Generator test set-up for evaluation of motor parameters	1 No.
4.	CRO 30MHz	1 No.
5.	Position Control Systems Kit (with manual) –Tacho Generator Coupling set	1 No.
6.	AC Synchro transmitter& receiver	1No.
7.	Sufficient number of Digital multi meters, speed and torque sensors	
8.	Arudino sensor	5 No.
Instrumentation		
9.	R, L, C Bridge kit (with manual)	
10.	Thermistor (silicon type) RTD nickel type	1No.
11.	30 psi Pressure chamber (complete set) – 1No. Current generator (0 – 20mA) Air foot pump – (with necessary connecting tubes)	1No.
12.	LVDT20mm core length movability type – 1No. CRO 30MHz	1No.
13.	Single phase Auto transformer Watt-hour meter (energy meter) Ammeter Voltmeter Rheostat Stop watch Connecting wires	1No
14.	IC Transistor kit	1No

S. No.	Description of Equipment	Quantity Required
15.	Instrumentation Amplifier kit	1No
16.	Analog – Digital and Digital –Analog converters (ADC and DACs)	1 No

EE1581	MICROPROCESSORS AND MICROCONTROLLERS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To develop the programming skills in 8085 microprocessor and 8051 microcontroller
- To interface sensors with Arduino

LIST OF EXPERIMENTS

8085 – Based Experiments

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
   (i) Ascending / Descending order, Maximum / Minimum of numbers.
   (ii) Programs using Rotate instructions.
3. Input and Output mode operations using 8255
4. To Generate Square wave using 8254

8051-Based Experiments

5. Demonstration of basic instructions with 8051 Micro controller execution, including:
   (i) Arithmetic instructions
   (ii) Conditional jumps & looping
6. Stepper motor control

ARDUINO Based Experiments:

7. Display letters in Arduino IDE environment
8. Interfacing Ultrasonic Sensor to measure the distance of an object
9. Interfacing IR sensor to detect the obstacles
10. Closed loop control of stepper and servo motor
11. Mini project using any microcontrollers

TOTAL: 60 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Develop and Execute simple programming in 8085

CO2: Demonstrate the interface concepts in 8085

CO3: Implement the control program using 8051

CO4: Write simple programs for Arduino.

CO5: Interface different sensors with Arduino

EE1521 PRESENTATION SKILLS AND TECHNICAL SEMINAR

L	T	P	C
0	0	2	1

OBJECTIVES:

- To encourage the students to study advanced engineering developments.
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of two periods per week, 15 students are expected to present the seminar. Each student is expected to present at least twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A course instructor is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

TOTAL: 30 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 : Comprehend the various technological developments in domain area of specialization.

CO2: Prepare a documentation report on the chosen topic of interest.

CO3: Give a formal technical presentation on the topic chosen.

EE1601 POWER ELECTRONICS AND DRIVES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on operation, characteristics and performance analysis of power semiconductor devices, converters and inverters.
- To impart knowledge on operation, and performance analysis of AC and DC motor drives.

UNIT I POWER SEMICONDUCTOR DEVICES 9

Study of switching devices – Power - DIODE, SCR, GTO, MOSFET, IGBT, IGCT, Triggering and commutation circuit for SCR, Driver and snubber circuit, Gate pulse generation circuit

UNIT II DC CONVERTERS 9

2-pulse converter, 3-pulse converter, 6-pulse converter, Dual Converters, Performance Parameters of converters, Effect of source inductance.

Introduction to types of choppers – Type A, Type B Choppers. Switched mode Regulators - Buck converter, Boost converter, Buck-Boost converter, Control

Strategy, Introduction to Resonant Converters.

UNIT III AC CONVERTERS **9**

Single phase voltage source inverters (120°&180° mode), Current source inverter, Applications. Single Phase AC Voltage controllers, Single phase cycloelectric - converter, Introduction to Matrix converters.

UNIT IV DC DRIVES **9**

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics –Selection of motor. Steady state analysis of the single and three phase converter fed separately excited DC motor drive –continuous conduction –4 quadrant operation of converter /chopper fed drive-Applications.

UNIT V AC DRIVES **9**

Stator voltage control–energy efficient drive–v/f control–constant airgap flux–field weakening mode – voltage – closed loop control. PWM techniques: Sinusoidal PWM, Modified sinusoidal PWM, Multiple PWM, Introduction to Space vector Modulation, Vector control of Induction Motors (Block Diagram).

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Explain the concept of different types of power semiconductor devices and its gating and triggering circuits.

CO2: Describe the various types of DC – DC converters.

CO3: Illustrate the concept of various types of AC converters.

CO4: Outline the characteristics of DC Drives

CO5: Classify different PWM techniques and outline the characteristics of AC Drives.

TEXT BOOKS:

1. Rashid, M.H., 2004. *Power Electronics Circuits, Devices, and Applications* 3'd Edition. Pearson education–2004.
2. Bimbhra, P.S. and Kaur, S., 2012. *Power electronics* (Vol. 2). Khanna publishers.

REFERENCES:

1. Krishnan, R., 2001. *Electric motor drives: modeling, analysis, and control.* Pearson.
2. Bose, B.K., 2002. *Modern power electronics and AC drives* (Vol. 123). Upper Saddle River, NJ: Prentice hall.

EE1602 **PROTECTION AND SWITCHGEAR** **L T P C**

3 0 0 3

OBJECTIVES:

- To discuss on the principles and need for protection schemes for different faults.
- To discuss on basic principles, construction and characteristics of different Electromagnetic relays.
- To discuss on protection schemes of different power equipment.
- To discuss on different aspects of static relays and numerical protection schemes.
- To discuss on the principles & construction of different types of circuit breaker.

UNIT I PROTECTION SCHEMES **9**

Principles and need for protection schemes – causes and Types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – Protection scheme - Current transformers and Potential transformers and their applications in protection schemes

UNIT II ELECTROMAGNETIC RELAYS **9**

Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION **9**

Transformer protection: Differential Protection - Buchholz Relay - Protection against Over-fluxing – Generator protection: Stator and Rotor protection – loss of excitation and prime mover - Motor protection: Electrical faults - Bus bar protection: Differential protection - Transmission line – Three stepped protection.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION **9**

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distance protection of transmission lines.

UNIT V CIRCUIT BREAKERS **9**

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching – current chopping - interruption of capacitive current - Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

Case Study: Air Circuit Breaker and Over Current relay in power house of college campus.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Analyze different types of faults and their effects on the power system and understand the practical significance of protection zones.

CO2: Explain the basic principle, construction and characteristics of different electromagnetic relays.

CO3: Discuss on protection schemes for different power equipment such as transformer, generator etc. against various electrical faults.

CO4: Elucidate static relays and various numerical protection schemes.

CO5: Describe the principle, construction, selection and problems associated with different types of circuit breaker.

TEXT BOOKS:

1. Paithankar, Y.G. and Bhide, S.R., 2011. *Fundamentals of power system protection*. PHI Learning Pvt. Ltd.
2. Rao, S.S., 1982. *Switchgear and Protection: Theory, Practice and Solved Problems*. Khanna publishers.

REFERENCES:

1. Ram, B., 2011. *Power system protection and switchgear*. Tata McGraw-Hill Education.
2. Ravindranath, B. and Chander, M., 1977. *Power system protection and switchgear*. New Age International.
3. Chakrabarti, A., Soni, M.L., Gupta, P.V. and Bhatnagar, U.S., 2000. A text book on Power System Engineering. *Dhanpar Rai and Co.(P) Ltd.*
4. Singh, R.P., 2009. *Switchgear and power system protection*. PHI Learning Pvt. Ltd.
5. Mehta, V.K. and Mehta, R., 2011. Principles of power systems, S. *Chand, New Delhi, India.*
6. Wadhwa, C.L., 2006. *Electrical power systems*. New Age International.

EE1603	RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To analyze topology of the stand-alone and grid connected photo-voltaic systems.
- To outline the various forms of wind energy conversion systems.
- To outline the concept of other non-conventional energy sources such as bio mass, hydro, ocean, geothermal etc.

UNIT I RENEWABLE ENERGY (RE) SOURCES **9**

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources(solar, wind,

biomass, ocean and geothermal), Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY 9

Basics of wind energy- Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine-Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs(DFIG,PMSG & SCIG based WPPs)- Siting of WPPs-Grid Connected and Stand alone WPPs

UNIT III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds.- Thermal Energy storage system with PCM-Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking (P&O and Incremental conductance algorithm), Applications.

UNIT IV BIOMASS & OTHER RE SOURCES 9

Introduction-Bio mass resources –Energy from Bio mass: conversion processes-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Essential components of hydroelectric system, Pumped Storage in Hydro power plants.

UNIT V OCEAN & MODERN ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able

CO1: To explain the importance of various renewable energy sources and its existing scenario in world.

CO2: To Analyze the different configurations of the wind energy conversion systems.

CO3: To Develop a stand-alone photo voltaic system with MPPT algorithm.

CO4: To Discuss the basic concepts of Biomass Energy and other renewable energy sources such as hydro, geothermal etc.

CO5: To elucidate the concepts of Ocean and modern energy sources such as fuel cell, batteries etc.

TEXT BOOKS:

1. Khan, B.H., 2006. *Non-conventional energy resources*. Tata McGraw-Hill Education.

REFERENCES:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.
3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.
4. Bradley A. Striebig,Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.

EE1671	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain through mathematical representation.
- To study various time to frequency domain transformation techniques
- To understand the computation algorithmic steps for Fourier Transform
- To study about filters and their design for digital implementation.
- To introduce the programmable digital signal processor & its application.

UNIT I INTRODUCTION **9**

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS **9**

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Linear and Circular Convolution.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION **9**

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure

UNIT IV DESIGN OF DIGITAL FILTERS **9**

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design – Butterworth and Chebyshev approximations; digital

design using impulse invariant and bilinear transformation - Warping, prewarping - Gibbs Phenomenon

UNIT V DIGITAL SIGNAL PROCESSORS **9**

Introduction – Architecture of TMSC5X DSP processor– Features – Addressing Formats – Functional modes - Introduction to Commercial DSP Processors

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Classify the given signal or system based on its mathematical representation and explains the various sampling and quantization techniques in digital signal representation.

CO2: Solve the given discrete time system using Z-transform and analyze its stability using frequency response and determine the DTFT of a given discrete sequence.

CO3: Compute DFT and Inverse DFT using Radix-2 FFT algorithm.

CO4: Design FIR filter using Windowing Technique and IIR filter using Bilinear Transformation and Impulse Invariant Techniques and also to design Analog filters for Butterworth and Chebyshev approximations.

CO5: Discuss the architecture and functional modes of commercial digital signal processors

TEXT BOOKS:

1. Proakis J.G. & Manolakis D.G., 2009, *Digital Signal Processing Principles, Algorithms and Applications*, Pearson Education.
2. Robert J.Schilling & Sandra L.Harris, 2014, *Introduction to Digital Signal Processing using MATLAB*, Cengage Learning.

REFERENCES:

1. Emmanuel C Ifeachor & Barrie W Jervis, 2009, Digital Signal Processing – A Practical approach, Pearson Education.
2. Alan V. Oppenheim, Ronald W. Schafer & John R. Buck., 2010, Discrete – Time Signal Processing, Pearson Education.
3. SenM.kuo, Woonsengs.gan, 2013, Digital Signal Processors, Architecture, Implementations & Applications, Pearson.
4. Mitra S. K., 2011, Digital Signal Processing – A Computer Based Approach, Tata McGraw Hill.
5. Venkataramani, B & Bhaskar, M., 2010, Digital Signal Processors, Architecture, Programming and Applications, Tata McGraw Hill.

EE1611	POWER ELECTRONICS AND DRIVES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To study the characteristics of various Power Electronic Devices.
- To impart knowledge in design of Power Converters
- To provide hands on experience in Motor Drives.

LIST OF EXPERIMENTS

1. Gate Pulse Generation using R, RC and UJT triggering circuit.
2. Characteristics of SCR and TRIAC
3. Characteristics of MOSFET and IGBT
4. Speed control of PMBLDC motor.
5. Performance Analysis of Half and Fully controlled Converter with R, RL and RLE load.
6. Performance Analysis of Step down and step up MOSFET based choppers
7. Performance Analysis of IGBT based single phase PWM inverter
8. Performance Analysis of IGBT based three phase PWM inverter
9. Performance Analysis of AC Voltage controller
10. Speed control of Induction motor.
11. Simulation of Power Electronic circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC - DC Converters, AC voltage controllers).

TOTAL: 60 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Obtain the characteristics of various power semiconductor devices.

CO2: Design and analyze half controlled / fully controlled converter circuits with various loads.

CO3: Illustrate PWM technique used in inverters.

CO4: Simulate and experiment various power electronic converter circuits.

CO5: Obtain the performance characteristics motor drives.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics (for SCR, MOSFET, TRIAC, GTO, IGCT and IGBT kit with built-in /discrete power supply and meters) - 2 each
2. Single phase SCR based half controlled converter and fully controlled converter along with built-in /separate/firing circuit/module and meter – 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) – 1 each
4. IGBT based single phase PWM inverter module/Discrete Component – 2
5. IGBT based three phase PWM inverter module/Discrete Component – 2
6. Switched mode power converter module/Discrete Component – 2
7. SCR &TRIAC based 1 phase AC controller along with lamp or rheostat load – 2

8. Cyclo converter kit with firing module – 1
9. Dual regulated DC power supply with common ground
10. Cathode ray Oscilloscope –10
11. Isolation Transformer – 5
12. Single phase Auto transformer –3
13. Components (Inductance, Capacitance) 3 set for each
14. Multi meter – 5
15. LCR meter – 3
16. Rheostats of various ranges – 2 sets of 10 value
17. Work tables – 10
18. DC and AC meters of required ranges – 20
19. Component data sheets to be provided
20. PMBLDC motor – 1

EE1612	RENEWABLE ENERGY SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To impart knowledge in design of Renewable Energy Sources and technologies.
- To provide adequate inputs on a variety of issues in harnessing Renewable Energy.
- To recognize current and possible future role of Renewable energy sources.

LIST OF EXPERIMENTS

1. Simulation study on Solar PV Energy System.
2. Experiment on "IV & PV Characteristics of Solar PV System".
3. Experiment on "Shadowing effect & diode based solution in Solar PV System".
4. Experiment on Performance assessment of Grid connected Solar Power System.
5. Experiment on Performance assessment of Standalone Solar Power System.
6. Simulation study on Wind Energy Generator.
7. Experiment on Performance assessment of micro Wind Energy Generator.
8. Simulation study on Hybrid (Solar-Wind) Power System.
9. Experiment on Performance Assessment of Hybrid (Solar-Wind) Power System.
10. Experiment on Performance Assessment of 100W Fuel Cell.
11. Simulation study of Energy storage technologies for RE Applications.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required	Quantity Required
1.	Personal Computers (Intel Core i3, 80 GB, 2 GB RAM)	15	-
2.	CRO	9	30 MHZ
3.	Digital Multimeter	10	Digital
4.	PV panels - 100W, 24V	1	-
5.	Battery storage system with charge and discharge control 40Ah	1	-
6.	PV Emulator	1	-
7.	Micro Wind Energy Generator module	1	-
Consumables (Minimum of 5 Nos. each)			
8.	Potentiometer	5	-
9.	Step-down transformer	5	230V/12-0-12V
10.	Component data sheets to be provided		

HS1621 VERBAL REASONING AND APTITUDE L T P C

0 0 2 1

OBJECTIVES:

- To improve their problem-solving skill.
- To give the basic idea about aptitude and reasoning for their GATE exam.
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully.

UNIT I NUMERICAL COMPUTATION 6

Percentages - Ratios – powers – exponents and logarithms – Permutation and combination

UNIT II ANALYTICAL APTITUDE 6

Logical Induction and Deduction – Analogy – Word analogy, Numerical Analogy, Mixed analogy, Image analogy.

UNIT III DATA INTERPRETATION 6

Table charts- Pie Charts- Bar Charts- Line Charts – Maps

UNIT IV VERBAL 6

Reading Comprehension- Sentence Rearrangement- Error Detection- Antonyms and Synonyms - Subject verb agreement - One word substitution

UNIT V INTERVIEW SKILLS 6

Self-Introduction- Individual presentation practice - Participating in group discussions - GD strategies - Interview etiquette - FAQs related to job interviews

TOTAL: 30 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Apply speed math tricks.

CO2: Develop their thinking ability.

CO3: Interpret data from various types of chart.

CO4: Apply their verbal skills to participate effectively in competitive exams.

CO5: Participate confidently in Group Discussions and Job interviews.

TEXT BOOKS:

1. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014.

REFERENCES:

1. Agarwal.R.S, "Quantitative Aptitude for Competitive Examinations", S.Chand Limited 2011.
2. Abhijit Guha, "Quantitative Aptitude for Competitive Examinations", Tata McGraw Hill, 3rd Edition, 2011.
3. Dr. R.S. Agarwal, "A modern approach to Verbal & Non-Verbal Reasoning", S. Chand Limited, 2nd Edition, 2018.
4. Edgar Thorpe, "Course in Mental ability and Quantitative Aptitude for Competitive Examinations", Tata McGraw Hill, 2nd Edition, 2001.
5. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.

Suggestions and Recommendations received from the Members:

- **EE1501 Power System Analysis**

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli said to include SMIB system in stability analysis.

- **EE1571 Control Systems**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai said to give assignments using MATLAB software.

- **EE1572 Microprocessors and Microcontrollers**

Dr. M. Sudalaimani, Assistant Professor Department of EEE Kamaraj College of Engineering and technology said to include Embedded C syllabus in Unit IV and Arduino and its applications may combine as a single unit as Unit V. Dr.M.Saravanan and Dr. Sishaj P Simon accepted this because some companies like Microchip may expect the students to know how to program the microcontroller particularly timer and serial port etc.

- **EE1511 Control and Instrumentation Laboratory**

BoS external/internal members approved the syllabus.

- **EE1581 Microprocessors and Microcontrollers Laboratory**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai said to include experiments based on Embedded C programming because PIC microcontroller kits along with hardware are available at low cost.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, said to reduce the experiments in 8085 since it is obsolete.

- **EE1521 Presentation Skills and Technical Seminar**

BoS external/internal members approved the syllabus.

- **EE1601 Power Electronics and Drives**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai said to include the topic titled "Introduction to BLDC motor drive" in Unit V.

Dr. K. Janakiraman Head – Technical M/s. OBO BETTERMANN India Pvt. Ltd., Chennai, informed some of the colleges have set up a practical lab (to make

them expertise in the field of drives) along with industries like Siemens. He also suggested incorporating such lab facilities in our college by contacting some vendors if possible.

- **EE1602 Protection and Switchgear**

BoS external/internal members approved the syllabus

- **EE1603 Renewable Energy Systems**

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli said to include SOLANKI, C. S. (2015). Solar Photovoltaics: Fundamentals, Technologies and Applications. India: PHI learning in one of the reference Books.

- **EE1671 Digital Signal Processing**

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, said to give programming or simulation assignments using MATLAB software.

- **EE1611 Power Electronics and Drives Laboratory**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai said to include the experiments like how converter is connected with low rating AC drives. Also he suggested to teach how to give connections in the converter, programming the drive with some basics etc. He also suggested to perform the analysis of DC motor when it is connected with half and fully controlled converter experimentally.

- **EE1612 Renewable Energy Systems Laboratory**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai said to remove fuel cell rating in experiment number 10.

- **HS1621 Verbal Reasoning and Aptitude**

BoS external/internal members approved the syllabus.

Item No: 003.04.02 - 003.04.04

Presentation of UG curriculum and syllabi of 5th and 6th semester Professional Elective courses and 5th semester Open elective courses.

Dr. M. Sudalaimani, Assistant Professor, Department of Electrical and Electronics Engineering presented the detailed syllabus of professional elective courses of 5th and 6th semester. He also presented the 5th semester open elective courses.

The following curriculum and syllabi for 5th and 6th semester professional and 5th semester open electives offered to other programme of study are presented and suggestions are invited from the BoS members.

S. No.	Course Code	Course Name	Category	Contact Periods	Credits			
					L	T	P	C
Professional Elective I (5th Semester)								
1.	EE1531	Design of Electrical Apparatus	PE	3	3	0	0	3
2.	EE1532	Internet of Things and Its Applications	PE	3	3	0	0	3
3.	EE1533	Machine Learning Algorithm for Electrical Engineering	PE	3	3	0	0	3
4.	EE1534	Power System Transients	PE	3	3	0	0	3
5.	EE1535	Special Electrical Machines	PE	3	3	0	0	3
Professional Elective II (6th Semester)								
1.	EE1631	Advanced Control Systems	PE	3	3	0	0	3
2.	EE1632	Electric Vehicles and Energy Management	PE	3	3	0	0	3
3.	EE1633	Energy Storage Technology	PE	3	3	0	0	3
4.	EE1634	Power Quality	PE	3	3	0	0	3
5.	EE1635	Principles of Robotics	PE	3	3	0	0	3

EE1531 DESIGN OF ELECTRICAL APPARATUS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the magnetic circuit parameters and design of lap and wave windings
- To design the core, yoke, windings and cooling systems of transformers.
- To design the armature and field systems for D.C. machines.
- To design the stator and rotor of induction machines and synchronous machines.
- To implement the computer aided design method for electrical apparatus provided

UNIT I DESIGN OF FIELD SYSTEM AND ARMATURE 9

Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Design of Magnetic circuits – Magnetizing current – Flux leakage – Leakage in Armature- Design of lap winding and wave winding.

UNIT II DESIGN OF TRANSFORMERS 9

Construction - kVA output for single and three phase transformers – Overall dimensions – Design of yoke, core and winding for core and shell type transformers Estimation of No-load current- Temperature rise in Transformers – Design of Tank and Cooling tubes of Transformers - Computer program: Complete Design of single-phase core transformer

UNIT III DESIGN OF DC MACHINES 9

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Carter's Coefficient - Selection of number of poles – Design of Armature – Design of commutator and brushes – Design of field - Computer program: Design of Armature main dimensions

UNIT IV DESIGN OF INDUCTION MOTORS 9

Construction - Output equation of Induction motor – Main dimensions – choice of specific loadings – Design of squirrel cage rotor and wound rotor – Design of rotor bars and slots – Design of end rings - short circuit current Circle diagram, Operating characteristics: Magnetizing current - Computer program: Design of slip-ring rotor

UNIT V DESIGN OF SYNCHRONOUS MACHINES 9

Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Determination of full load field MMF - Design of rotor –Design of damper winding — Design of field winding – -Computer program: Design of Stator main dimensions-Brushless DC Machines

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Explain the design considerations for rotating and static electrical machines and its field system
CO2: Design various parts of single and three phase transformers using suitable equations.
CO3: Design armature and field circuit of DC machines using output equations.
CO4: Design different types of induction motor (squirrel cage and wound rotor) using its output equations.
CO5: Design and analyze the stator and rotors parts of synchronous machines using its output equation.

TEXTBOOKS:

1. Sawhney, A.K., 1976. *A course in electrical machine design*. Dhanpat Rai and Sons.
2. V Rajini, V.S Nagarajan, 2017. *Electrical Machine Design*, Pearson.

REFERENCES:

1. Sen, S.K., 2009. *Principles of Electrical Machine Designs with Computer Programmes.* Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. M V Deshpande, 2011. *Design and Testing of Electrical Machines*. PHI learning Pvt Lt.
3. A.Shanmugasundaram, G.Gangadharan, R.Palani, 2007. *Electrical Machine Design Data Book*, New Age International Pvt. Ltd., Reprint.

EE1532	INTERNET OF THINGS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I INTRODUCTION TO IoT **9**

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack — Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and connecting Smart Objects.

UNIT II IoT PROTOCOLS **9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and

Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

UNIT III DESIGN AND DEVELOPMENT 9

Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

UNIT V ELECTRICAL DOMAIN APPLICATIONS 9

Real world design constraints - Applications - Battery management system, Inverter power quality investigation, Industrial automation, smart grid, Home automation, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT, Electric vehicle and intelligent transportation systems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 : Interpolate the evolution and simple architecture of Internet of Things.
CO2 : Analyze various protocols in different layers for IoT.
CO3: Design a portable IoT using Rasperry Pi/Ardiuno.
CO4 : Discuss the concept of data analytics and cloud environment in IoT.
CO5 : Examine applications of IoT in electrical and its allied fields.

TEXT BOOKS:

1. Bahga, A. and Madisetti, V., 2018. *Internet of Things: A hands-on approach*. Vpt.
2. Uckelmann, D., Harrison, M. and Michahelles, F. eds., 2017. *Architecting the internet of things*. Springer Science & Business Media.

REFERENCES:

1. Zhou, H., 2012. *The internet of things in the cloud*. Boca Raton, FL: CRC press.
2. Holler, J., Tsiatsis, V., Mulligan, C., Karnouskos, S., Avesand, S. and Boyle, D., 2014. *Internet of Things*. Academic Press.
3. Hersent, O., Boswarthick, D. and Elloumi, O., 2012. *The internet of things: Key applications and protocols*. John Wiley & Sons.

EE1533	MACHINE LEARNING ALGORITHM FOR ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Analyze and identify significant characteristics of data sets.
- Develop an understanding of training a learning algorithm including over-fitting, noise, convergence and stopping criteria.
- Match a data set with the most promising inductive learning algorithms.
- Understand and implement the training, testing, and validation phases of learning algorithms development and deployment.
- Determine the computational complexity associated with development and execution of learning algorithms for a given data set.

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Introduction to Machine Learning, supervised, unsupervised, reinforcement and semi-supervised modelling / learning -Machine Learning pipeline.

UNIT II SUPERVISED LEARNING 9

Linear Models for Regression –Linear Basis Function Models –The Bias-Variance Decomposition –Bayesian Linear Regression –Common Regression Algorithms – Simple Linear Regression –Multiple Linear Regression –Linear Models for Classification –Discriminant Functions –Probabilistic Generative Models – Probabilistic Discriminative Models –Laplace Approximation –Bayesian Logistic Regression –Common Classification.

Applications of Supervised learning in Load forecasting, Solar forecasting, Wind Prediction and Electricity Price forecasting,

UNIT III UNSUPERVISED LEARNING 9

Mixture Models and EM–K-Means Clustering –Dirichlet Process Mixture Models –Spectral Clustering –Hierarchical Clustering –The Curse of Dimensionality – Dimensionality Reduction –Principal Component Analysis –Latent Variable Models(LVM) –Latent Dirichlet Allocation (LDA). Applications of Unsupervised learning in dynamic security assessment.

UNIT IV ADVANCED LEARNING 9

Reinforcement Learning –Representation Learning –Neural Networks –Active Learning –Ensemble Learning, Bootstrap Aggregation –Boosting –Gradient Boosting Machines –Deep Learning Applications of Unsupervised learning in transient stability assessment of power systems.

UNIT V WEKA TOOL 9

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners. Applications of WEKA tool in data analytics of Energy consumption

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Define fundamental machine learning models (linear regression, logistic regression, polynomial regression, decision trees, support vector machines, PCA).

CO2: Describe, design, and optimize a regression model.

CO3: Describe, design, and optimize a clustering model.

CO4: Estimate the pricing for reinforcement learning by applying various methods.

CO5: Apply simple machine learning models to engineering applications using WEKA.

TEXT BOOKS:

1. Géron, A., 2019. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems*. O'Reilly Media.
2. Ayodele, T.O., 2010. Introduction to machine learning. *New Advances in Machine Learning*, pp.1-9.

REFERENCES:

1. Chen, Chong, et al. "Energy consumption modelling using deep learning embedded semi-supervised learning." *Computers & Industrial Engineering* 135 (2019): 757-765.
2. Zhang, R., Wu, J., Xu, Y., Li, B. and Shao, M., 2019. A hierarchical self-adaptive method for post-disturbance transient stability assessment of power systems using an integrated CNN-based ensemble classifier. *Energies*, *12*(17), p.3217.
3. Fenner, M., 2019. *Machine learning with Python for everyone*. Addison-Wesley Professional- Pearson Education.

EE1534	POWER SYSTEM TRANSIENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge about the following topics:

- Generation of switching transients and their control using circuit – theoretical concept.
- Mechanism of lighting strokes and the production of lighting surges.
- Propagation, reflection and refraction of travelling waves.
- Voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY 9

Review and importance of the study of transients - causes for transients. - double frequency transients -. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning. Case Study: Simulation model of switching of a RL/RLC circuits

UNIT II SWITCHING TRANSIENTS **9**

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS **9**

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes– model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS **9**

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling
waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM **9**

The short line and kilometric fault - distribution of voltages in a power system – Line dropping and load rejection - voltage transients on closing and reclosing lines – over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation using PSCAD/EMTDC.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Explain the causes, effects and different types of power system transients

CO2: Describe the concept of switching transients and their control circuit.

CO3: Understand the mechanism of lighting strokes and their associated theories.

CO4: Illustrate the importance of propagation, reflection and refraction of travelling waves.

CO5: Explain voltage transients caused by faults. Circuit breaker action and load rejection on integrated power system.

TEXT BOOK:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2ndEdition, 1991.

REFERENCES:

1. Pritindra Chowdhari, "Electromagnetic transients in Power System", John

Wiley and
Sons Inc., Second Edition, 2009.
2. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients – A statistical
approach', PHI Learning Private Limited, Second Edition, 2010.

EE1535	SPECIAL ELECTRICAL MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on the following topics

- Construction, principle of operation, control and performance of stepping motors.
- Construction, principle of operation, control and performance of switched reluctance motors.
- Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- Construction, principle of operation and performance of permanent magnet synchronous motors.
- Construction, principle of operation and performance of other special machines

UNIT I STEPPER MOTORS 9

Constructional features –Principle of operation –Types – Torque predictions – Linear Analysis – Characteristics – Drive circuits and current suppression schemes for stepper motor – Closed loop control – Concept of lead angle – Applications of stepper motors in computer peripherals, robotics and 3D printers.

UNIT II SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features –Principle of operation- Torque prediction–Characteristics - Steady state performance prediction – Analytical Method – Current control schemes- Hysteresis and PWM- Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Disadvantages of BLDC motor-Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Power Converter Circuits and their controllers - Characteristics and control- Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Constructional features -Principle of operation – EMF and Torque equations - Sine wave motor with practical windings - Phasor diagram - Power controllers –

performance characteristics -Digital controllers – Comparison of PMSM and PMBLDC -Applications.

UNIT V OTHER SPECIAL MACHINES 9

Constructional features – Principle of operation and Characteristics of Hysteresis motor- Synchronous Reluctance Motor–Linear Induction motor-Repulsion motor-AC series motor-Universal motor- Applications.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Interpret the various modes of excitations, drive circuits and control techniques of stepper motor.

CO2: Explicate the Construction, working and Performance of Switched Reluctance Motor

CO3: Analyze the various applications of PMBLDC Motor based on its performance.

CO4: Apply Permanent Magnet Synchronous Motor Drive in an appropriate application based on its performance.

CO5: Explicate the Construction, working and Performance of Hysteresis Motor, Synchronous Reluctance motor, Linear Induction Motor, AC series motor, Universal motor & Repulsion motor.

TEXT BOOKS:

1. Veṅkaṭaratnam, K., 2009. *Special electrical machines*.
2. Kenjo, T., 1984. Stepping Motors and Their Microprocessor Controls, Clarendon. *Oxford, UK*, *4*, pp.620-625.

REFERENCES:

1. Janardanan, E.G., 2014. *Special electrical machines*. PHI Learning Pvt. Ltd.
2. Krishnan, R., 2017. *Switched reluctance motor drives: modeling, simulation, analysis, design, and applications*. CRC press.
3. Kenjō, T. and Nagamori, S., 1985. *Permanent-magnet and brushless DC motors* (Vol. 18). Clarendon Press.
4. Miller, T.J., 1989. Brushless permanent-magnet and reluctance motor drives.

EE1631 **ADVANCED CONTROL SYSTEMS** **L T P C**

3 0 0 3

OBJECTIVES:

To impart knowledge on

- On the design of state feedback control and state observer.
- On phase plane analysis.
- Basics of Digital Control system
- Use of describing function analysis for Non Linear Systems
- Design of optimal controller and estimators

UNIT I STATE VARIABLE ANALYSIS **9**

Introduction- concepts of state variables and state model-State model for linear continuous time systems, Diagonalisation- solution of state equations, State Transition matrix, Concepts of controllability and observability.

UNIT II STATE VARIABLE DESIGN **9**

Introduction to state model: Effect of state feedback - Pole placement design: Necessary and sufficient condition for arbitrary pole placement, State regulator design - Design of state observers- Separation principle- Design of servo systems: State feedback with integral control.

UNIT III SAMPLED DATA ANALYSIS **9**

Introduction spectrum analysis of sampling process signal reconstruction difference equations The Z transform function, the inverse Z transform function, response of Linear discrete system, the Z transform analysis of sampled data control systems, response between sampling instants, the Z and
S domain relationship. Stability analysis and compensation techniques.

UNIT IV NON LINEAR SYSTEMS **9**

Introduction, common physical non linearity's, The phase plane method: concepts, singular points, stability of non linear systems, construction of phase trajectories system analysis by phase plane method. The describing function method, stability analysis by describing function method, Jump resonance.

UNIT V OPTIMAL CONTROL **9**

Introduction: Classical control - P, PI, PID Controllers & Basic Tuning Methods - Optimization, formulation of optimal control problem, Typical optimal control performance measures - Optimal state regulator design: Lyapunov equation, Matrix Riccati equation - LQR steady state optimal control – Application examples.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Interpret a given linear system in State Space Model

CO2: Apply the concepts of State Space Analysis for designing state feedback controller and state observer.

CO3: Interpret a given Digital Control system and test its Stability
CO4: Apply describing function method for interpreting Non Linear Systems
CO5: Design and analyze an optimal controller for any specific application

TEXT BOOKS:

1. M.Gopal, "Digital Control and State Variable Methods", 4th edition, Mc Graw Hill India, 2012

REFERENCES

1. Ogata, K. and Yang, Y., 2002. Modern control engineering, Edition 4, India: Prentice hall.
2. Mohandas, K.P., 2006. Modern Control Engineering. Sanguine, India.
3. Gopal, M., 2014. Modern control system theory. New Age International.

EE1632	ELECTRIC VEHICLES AND ENERGY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the working of Electric Vehicles and its energy management.
- To apply the concept of different Power Converter topologies in Electric Vehicle applications.

UNIT I INTRODUCTION TO ELECTRIC VEHICLES 9

Introduction to conventional vehicles, electric drive – trains: Basic concepts of Electric traction, Introduction to various electric drive – train topologies, Power flow control in electric drive – efficiency analysis.

UNIT II ELECTRIC PROPULSION UNIT 9

Introduction to electric drives , DC/DC chopper based four quadrant operations of DC drives, Inverter based V/f Operation (motoring and braking) of induction motor drive system, Induction motor based vector control operation Configuration and control of Permanent magnet motor drives, Configuration and control of switched reluctance motor drives, BLDC drives.

UNIT III ENERGY STORAGE 9

Introduction to energy storage requirement in electric vehicles, Battery, Fuel cell, Super capacitor and flywheel based energy storage and its analysis. Introduction to Batteries, Different types, Battery Parameters, Battery modeling, Battery Management system for Lithium ion Batteries.

UNIT IV DRIVE SYSTEM 9

Sizing of propulsion motor, Sizing of Power Electronic converters, Selection of energy storage technology, communications, and supporting sub systems.

UNIT V ENERGY MANAGEMENT STRATEGIES 9

Introduction to Energy Management Strategies used for electric vehicles - Classification, comparison, Implementation issues. Case study: Battery Electric Vehicle (BEV).

Introduction to V2G and G2V technology.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Discuss on basic concept of electric traction and various train topologies.

CO2: Choose a suitable drive scheme for developing a hybrid electric vehicle depending on available resources.

CO3: Identify the appropriate energy storage system for electric vehicle applications.

CO4: Explicate the sizing and selection of various sub systems in electric vehicle Application.

CO5: Illustrate the various strategies of energy Management system used in Electric vehicle application.

TEXT BOOKS:

1. Husain, I., 2011. *Electric and hybrid vehicles: design fundamentals*. CRC press.
2. Ehsani, M., Gao, Y., Longo, S. and Ebrahimi, K., 2018. *Modern electric, hybrid electric, and fuel cell vehicles*. CRC press.
3. Onori, S., Serrao, L. and Rizzoni, G., 2016. Hybrid electric vehicles: Energy management strategies.

REFERENCES:

1. Soylu, S. ed., 2011. *Electric vehicles: modelling and simulations*. BoD–Books on Demand
2. Williamson, S.S., 2013. *Energy management strategies for electric and plug-in hybrid electric vehicles*. New York: Springer.

EE1633 ENERGY STORAGE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge about the following topics:

- To Study details of various energy storage systems along with their applications
- Enabling to identify the optimal solutions to a particular energy storage applications/ utility

UNIT I Introduction to Energy Storage Systems **9**

Necessity of energy storage, different types of energy storage, mechanical, chemical, electrical, electrochemical, biological, magnetic, electromagnetic, thermal and Compressed air storage technology, comparison of energy storage technologies

UNIT II Thermal Energy Storage Systems 9

Thermal Energy storage, sensible and latent heat, phase change materials, Energy and exergy analysis of thermal energy storage, Mechanical-Pumped hydro, flywheels and pressurized air energy storage

UNIT III Electric and Magnetic Energy Storage Systems 9

Electrical Energy storage-super-capacitors, Magnetic Energy Storage-Superconducting systems,

UNIT IV Electrochemical Energy Storage Systems 9

Principle of direct energy conversion using fuel cells, thermodynamics of fuel cells, Types of fuel cells, AFC, PEMFC, MCFC, SOFC, Microbial fuel cell, Fuel cell performance, Electrochemical Energy Storage- Battery, primary, secondary and flow batteries,

UNIT V Design and Applications of Energy Storage Systems 9

Renewable energy storage-Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale application-Portable storage systems and medical devices, Mobile storage Applications- Electric vehicles (EVs), types of EVs, batteries and fuel cells, future technologies, hybrid systems for energy storage.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Outline the basic concepts and need of different energy storage systems

CO2: Relate the various types of thermal energy storage systems

CO3: Summarize the different types related to electric and magnetic energy storage systems

CO4: Explain principle of operation and types of various electrochemical storage systems such as fuel cells, battery

CO5: Illustrate the design and applications of energy storage systems

TEXT BOOKS:

1. Ahmed Faheem Zobaa ,Energy *Storage - Technologies and Applications* , InTech.

REFERENCES:

1. J. Jensen and B. Sorenson ,*Fundamentals of Energy Storage, Wiley-Interscience*, New York,
2. C. Daniel, J. O. Besenhard ,*Handbook of battery materials* ,Wiley VCH Verlag GmbH & Co. KgaA.
3. G. Pistoia ,*Electric & Hybrid Vehicles* , Elsevier B. V.
4. Dincer I. and Rosen M. A ,*Thermal energy storage: Systems and Applications* , Wiley pub.
5. Huggins R. A., ,*Energy Storage: Fundamentals, Materials and Applications*, Springer

EE1634	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To realize the various power quality issues.
- To instruct on production of voltages sags, over voltages and harmonics and methods of control.
- To decide the passive compensation techniques used for power factor correction and load voltage regulation
- To impart knowledge on various methods of power quality monitoring

UNIT I INTRODUCTION TO POWER QUALITY 9

Terms and Definitions of Power Quality- Need for a quality power - General Classes of Power Quality Problems- Transients - Long-Duration Voltage Variations - Short-Duration Voltage Variations - Voltage Imbalance - Waveform Distortion - Voltage Fluctuation- Power Frequency Variations- Power Quality Terms- CBEMA Curves

UNIT II VOLTAGE SAG AND SWELL 9

Estimating voltage sag performance - Analysis and calculation of various faulted condition - Estimation of the sag severity - Mitigation of voltage sag, Static transfer switches and fast transfer switches. - Capacitor switching – Lightning - Ferro resonance - Mitigation of voltage swell.

UNIT III HARMONICS 9

Harmonic sources from commercial and industrial loads - Locating harmonic sources – Power system response characteristics - Harmonics Vs transients. Effect of harmonics – Harmonic distortion - Voltage and current distortions - Harmonic indices - Inter harmonics – Resonance Harmonic distortion evaluation, IEEE and IEC standards

UNIT IV CUSTOM POWER DEVICES 9

Construction, Working and limitation: Distribution STATCOM (D- STATCOM), Dynamic Voltage Restorer (DVR), Unified Power Quality Conditioner (UPQC).

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations – Power Quality measurement equipment: Multimeters, Oscilloscopes, Harmonic / spectrum analyzer, Flicker meters, Disturbance analyzer, Combination disturbance and harmonic analyzers - Applications of expert systems - Power Quality Monitoring Standards: IEEE 1159 and IEC (61000-4-30).

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Describe various sources, causes and effects of power quality issues,

electrical systems and their measures and mitigation.
CO2: Explore the causes & Mitigation techniques of various PQ events.
CO3: Illustrate the concept of various Active & Passive power filters used for harmonic mitigation.
CO4: Describe the construction working & limitation of custom power devices (D- STATCOM DVR & UPQC).
CO5: Discuss on various methods of power quality monitoring & their standards.

TEXT BOOKS:

1. Dugan, R.C., McGranaghan, M.F. and Beaty, H.W., 1996. *Electrical power systems quality. epsq.*

REFERENCES:

1. Singh, B., Chandra, A. and Al-Haddad, K., 2014. *Power quality: problems and mitigation techniques*. John Wiley & Sons.
2. Heydt, G.T., 1991. *Electric power quality* (pp. 1985-1993). West Lafayette, IN: Stars in a circle publications.

EE1635	PRINCIPLES OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

UNIT I BASIC CONCEPTS 9

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II DIRECT AND INVERSE KINEMATICS 9

Mathematical representation of Robots - Position and orientation – Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV PATH PLANNING 9

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V DYNAMICS AND CONTROL 9

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model –Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Explain the types of robots and design of controllers/manipulators

CO2: Explain the basic representations of robots and degrees of freedom

CO3: Describe the differential motion of manipulators and its static analysis.

CO4: Illustrate the concept of various path planning techniques for robot movement.

CO5: Develop dynamic model and describe the various control schemes incorporated in robotics.

TEXT BOOKS:

1. R.K.Mittal and I.J.Nagrath, *Robotics and Control*, Tata McGraw Hill, New Delhi, 4th Reprint, 2005.

REFERENCES:

1. JohnJ.Craig , *Introduction to Robotics Mechanics and Control*, Third edition, Pearson Education, 2009.
2. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, *Industrial Robotics*, McGraw-Hill Singapore, 1996.

Suggestions and Recommendations received from the Members:

- **EE1531 Design of Electrical Apparatus**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai discussed on the type of software we are planning to use for designing the machines computer programming part in each unit.

Dr. M. Sudalaimani, Assistant Professor Department of EEE Kamaraj College of Engineering and technology shared that we are planning to use either AUTOCAD or ECAD. **Dr. M. Saravanan** suggested that we can try some machine design related softwares like Simcenter MAGNET software or Altair Flux. He also discussed that covering the theory itself will be lengthy and the

computer programming part can be given as assignments to use the softwares for machine design.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli also agreed with **Dr. M. Saravanan**, that the portion is little lengthy and the number of hours will be sufficient just enough to cover the theory alone.

Ms. R. Reenu, Assistant Professor Department of EEE Kamaraj College of Engineering and technology, shared that in Anna University R2013, the computer programming topics were not included and it was updated in the Anna University R2017.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli enquired on what syllabus they are including in the computer programming.

Ms. R. Reenu, Assistant Professor Department of EEE Kamaraj College of Engineering and technology, discussed that in the textbook given in the syllabus, the computer programming has been implemented using the MATLAB coding. And also shared that since the topics in the syllabus are lengthy to cover within the hours allotted, the computer programming coding in MATLAB is being given an overview only.

- **EE1532 Internet of Things and Its Applications**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai discussed on the syllabus framing, on whether it was from any EEE Anna University regulation or discussed with other departments.

Dr. D. Prince Winston, Professor Department of EEE Kamaraj College of Engineering and technology informed that it has been framed in consultation with ECE and CSE departments.

Dr. M. Saravanan suggested to check the syllabus weightage in each unit so that it can be covered comfortably within the allotted hours. Especially in the Unit 5, where so many applications were given for discussion.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli enquired that that since we have given the objective of the course as ' to build an IoT systems', how we are going to build IoT systems for this course.

Dr. M. Saravanan suggested that the assignment itself shall be given as an 'Mini Project' and implemented and student teams shall be created for designing.

- **EE1533 Machine Learning Algorithm for Electrical Engineering**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai suggested that in the title it should be edited as either 'Algorithms' or 'Techniques'.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli suggested not to have the word 'algorithm' in the title. And instead the word 'applications' seemed good since we are discussing some application in each unit for explaining the algorithms.

Dr. Sishaj P. Simon and Dr. M. Saravanan discussed to have the title as 'Machine Learning Applications for Electrical Engineering'.

- **EE1534 Power System Transients**

Dr. M. Saravanan, Professor Department of EEE Thiagarajar College of Engineering, Madurai enquired if we have included PSCAD software in the syllabus as it a good software for working on transients and assignments can be given for students in these softwares,

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli suggested to use IEC 62305 for the basic lightning analysis in the transient characteristic for better understanding.

- **EE1535 Special Electrical Machines**

BoS external/internal members approved the syllabus.

- **EE1631 Advanced Control Systems**

BoS external/internal members approved the syllabus.

- **EE1632 Electric Vehicles and Energy Management**

BoS external/internal members approved the syllabus.

- **EE1633 Energy Storage Technology**

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli enquired if we have included the compressed air technology and flywheel in our syllabus.

- **EE1634 Power Quality**

BoS external/internal members approved the syllabus.

- **EE1635 Principles of Robotics**

BoS external/internal members approved the syllabus.

Open Electives offered by Department of EEE

S. No.	Course Code	Course Name	Category	Contact Periods	Credits				Offered to Dept.
					L	T	P	C	
Open Elective I (5th Semester)									
1.	OEE151	Bio Electronics	OE	3	3	0	0	3	BT
2.	OEE152	Control System Analysis	OE	3	3	0	0	3	AD, CSE, IT
3.	OEE153	Green Building	OE	3	3	0	0	3	MECH, MTR
4.	OEE154	Renewable Energy Sources	OE	3	3	0	0	3	ALL

S. No.	Course Code	Course Name	Category	Contact Periods	Credits				Offered to Dept.
					L	T	P	C	
5.	OEE155	Soft Computing Techniques and Applications	OE	3	3	0	0	3	ALL

OEE151 **BIO ELECTRONICS** **L T P C**

3 0 0 3

OBJECTIVES:

- To explain the fundamental principles of electronics.
- To learn about basics of digital and logic circuits.
- To discuss basic biological materials and motion in solution.
- To describe the concepts of electrolyte.
- To develop knowledge on bio inspired real time systems.

UNIT I BASIC ELECTRONICS **9**

Semiconductor Materials, chemical and physical bonds, Intrinsic and extrinsic semiconductors, carrier motion in semiconductors – Drift, Diffusion and Recombination – Generation process, Boltzmann Transport equation, P-N junction diode, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), Operational Amplifier (OPAMP).

UNIT II DIGITAL LOGIC CIRCUITS **9**

Boolean algebra and logic gates, Combinational logic circuit, sequential logic circuit – flip flops.

UNIT III BIOLOGICAL MATERIALS AND CHEMICAL REACTION **9**

Analogy between semiconductor and biological materials, water and electrolyte solutions; biological molecules - Proteins, Nucleic acids, Phospholipids, cell membrane, Eucaryotic cell, Diffusion, Brownian motion, electrophoresis, enzyme kinetics.

UNIT IV SOLID ELECTROLYTE JUNCTION **9**

Electrode-electrolyte interfaces, Poisson – Boltzmann equation, Membrane transport, Nernst-Plank equation and solution.

UNIT V BIO INSPIRED SYSTEMS **9**

Artificial heart and circulatory assist devices, artificial lungs, artificial kidney, artificial cell, artificial muscle, Robotic systems and devices, acoustical systems, computing system such as neural network, bio inspired exploration, bio inspired computer architectures.

TOTAL: 45 PERIODS

OUTCOMES:

Upon successful completion of this course, the students will be able to

CO1 : Interpolate the fundamentals of electronics.

CO2 : Explain the elements of power semiconductor devices and digital logic circuits.

CO3 : Infer various biological materials and its motion .

CO4 : Discuss about chemical reaction of various electrolytes.

CO5 : Examine artificial and real time bio inspired systems.

TEXT BOOKS:

1. Grattarola, M. and Massobrio, G., 1998. *Bioelectronics handbook.* McGraw-Hill.
2. E. A. Hall, *Biosensors*, Publisher : Wiley.
3. Ruddy Ratner, *Biomaterial Science* Publisher: Academic Press.
4. S. Bone, B. Zabba, *Bioelectronics*, Publisher : Wiley.
5. Malvino, A.P., Bates, D.J. and Hoppe, P.E., 1993. *Electronic principles.* Glencoe.

REFERENCES:

1. M Farkas; *Dynamical Model in Biology*; Publisher: Academic Press.
2. B Webb, T R Consi *Biorobotics*; Publisher: AAAI Press
3. Williams, K., 2003. *Insectronics: build your own walking robot.* TAB/Electronics.
4. *Amphoibionics: Built Your own biologically Inspired Reptilian Robot*; *Bioinspired Nanoscale Hybrid System :* Conference Proceeding Held on Nov'02, Editor : Author: G. Schmid, Online Book Store: Amazon

		L	T	P	C
OEE152	**CONTROL SYSTEMS ANALYSIS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the basic control system components for the analysis of physical systems.
- To provide adequate knowledge on the time response analysis and steady state error analysis of linear systems.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency response analysis of linear systems.
- To introduce the concepts of stability analysis and design of various types of compensators.
- To introduce state variable representation of physical systems and to convert the state space models into transfer function models and vice versa

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block

diagram Models-Signal flow graphs models- Multivariable control system – Case Study: DC and AC servo Systems-Synchros

UNIT II TIME REPONSE ANALYSIS 9

Transient response - Steady state response- Measure of performance of the standard first order and second order systems - Effect of an additional zero and an additional pole - Steady state error constant and system- Type number- PID control -Analytical design for PD,PI,PID control systems.

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Closed loop frequency response- Performance specifications in frequency domain- Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots- Cascade lead compensation- Cascade lag compensation- Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability- Bounded - Input Bounded - Output stability-Routh stability criterion-

Relative stability- Root locus concept- Guidelines for sketching root locus- Nyquist stability

criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation- Conversion of state variable models to transfer functions-

Conversion of transfer functions to state variable models- Solution of state equations- Concepts of Controllability and Observability- Stability of linear systems- Equivalence between transfer function and state variable representations- State variable analysis of digital control system- Digital control design using state feedback.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Develop mathematical models for various physical systems.

CO2: Determine time-domain specifications of given linear system and discuss on applications of various types of conventional controllers (P, PI and PID)

CO3: Obtain the frequency response analysis of given linear system using bode and polar plot.

CO4: Analyze the stability of control system using suitable methods and design compensators for the given specifications.

CO5: Design various transfer functions of digital control system using state variable models.

TEXT BOOKS:

1. Nagrath, I.J., 2018. *Control systems engineering*. New Age International
2. Kuo, B.C., 2018. *Automatic control systems*. Wiley.

REFERENCES:

1. Gopal, M., 2012. *Control systems: principles and design*. Tata McGraw-Hill Education.
2. Ogata, K. and Yang, Y., 2002. *Modern control engineering* (Vol. 4). India: Prentice hall.
3. Dorf, R.C. and Bishop, R.H., 2011. *Modern control systems*. Pearson.
4. Dutton, K., 1997. *The art of control engineering*. Addison-Wesley Longman Publishing Co., Inc..
5. Houpis, C.H. and Sheldon, S.N., 2013. *Linear Control System Analysis and Design with MATLAB®*. CRC Press.
6. NPTEL Video Lecture Notes on "Control Engineering"

		L	T	P	C
OEE153	**GREEN BUILDING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the effects on environment, by buildings
- To acquire knowledge on the utilization of natural energy while constructing buildings
- To understand about the concept of passive solar cooling and heating.
- To impart knowledge about the various energy efficient technologies in buildings
- To comprehend various techniques that are used in Indian Green Buildings.

UNIT I ENVIRONMENTAL IMPLICATIONS OF BUILDINGS 10

Energy use, carbon emissions, water use, waste disposal - Building materials: sources, methods of production and environmental Implications - Embodied Energy in Building Materials - Transportation Energy for Building Materials - Maintenance Energy for Buildings. Green Buildings and its necessity.

UNIT II PRINCIPLES OF GREEN BUILDING DESIGN 9

Energy conservation in buildings – Day lighting – Water heating and photovoltaic systems – Advances in thermal insulation – Heat gain/loss through building components – Solar architecture - Green Buildings – Indian Green Building council ratings for New and Existing buildings.

UNIT III UTILITY OF SOLAR ENERGY IN BUILDINGS 9

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings.

Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.

UNIT IV EFFICIENT TECHNOLOGIES IN ELECTRICAL SYSTEMS **9**

Maximum demand controllers - Automatic power factor controllers - Energy efficient motors and soft starters - Energy efficient Transformers, Energy Efficient Lighting systems – Occupancy sensors- Energy Performance index

UNIT V GREEN BUILDINGS IN INDIA – CASE STUDIES **8**

Rajiv Gandhi International Airport, Hyderabad – Suzlon one earth campus, Pune – Infinity Benchmark, Pune – The ITC green centre, Gurgaon - CII-Sohrabji Godrej Green Business Centre, Hyderabad - Infosys, Mysore – T-Zed Homes, Bengaluru – Raintree hotel, Chennai.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Demonstrate the energy spent in rising a building and carbon emission.

CO2: Explain the principles to be adopted in construction of Green buildings

CO3: Describe the ways in which solar energy can be utilized in building.

CO4: Apply energy efficient technologies in the electrical systems of buildings.

CO5: Analyse the technology adopted in various Green buildings.

TEXTBOOKS:

1. Clarke J. A., 2001. *Energy Simulation in Building Design*, 2nd Edition, Butterworth.
2. Nayak J. K. and Prajapati J. A. 2006. *Handbook on Energy Conscious Buildings*, Pilot edition, Solar Energy centre, MNES.
3. Jagadish K.S., Venkataramareddy B. U. and Nanjundarao K. S. 2017. *Alternative Building Materials and Technologies*. 2nd Edition, New Age International.
4. Ursula Eicker, 2009. *Low Energy Cooling For Sustainable Buildings.* 1st Edition, Wiley.

   2004. *Sustainable Building Design Manual. Volume 1 and 2*, TERI.

REFERENCES:

1. Osman Attmann, 2010. *Green Architecture Advanced Technologies and Materials*. 1st Edition McGraw Hill.
2. Jerry Yudelson, 2009. *Green building Through Integrated Design.* 1st Edition. McGraw Hill, 2009.
3. Marian Keeler and Bill Burke, 2009. *Fundamentals of Integrated Design for Sustainable Building.* 1st Edition, John Wiley & sons.
4. Sodha M. S., Bansal N. K, Bansal P. K., Kumar A. and Malik. M. A. S., 1986. *Solar Passive Building: Science and Design*, 1st Edition, Pergamon

Press.
5. Albert Thumann and Paul Mehta, 2013. *Handbook of Energy Engineering,* 7th Edition, River Publishers.

OEE154	RENEWABLE ENERGY SOURCES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the significance of renewable energy resources.
- To get exposure on various renewable energy sources and its environmental impact.
- To learn about the solar, wind and biomass energy and its economic aspects.
- To know the various types and its function of geothermal energy ocean energy & fuel cell.

UNIT I INTRODUCTION TO RENEWABLE ENERGY SOURCES 9

Classification of Energy Sources- Importance of Non-Conventional Energy Sources- Energy Chain- Common Forms of Energy - Advantages and Disadvantages of Conventional Energy Sources - Salient Features of Non-Conventional Energy Sources - Environmental Aspects of Energy – Introduction to Energy Conservation - important aspects of energy conservation - Energy Storage: Necessity of Energy Storage, Energy Storage Devices and Energy Storage Methods.

UNIT II SOLAR PV AND THERMAL ENERGY 9

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance - solar thermal power plants - Thermal energy storage for solar heating and cooling - limitations. Solar PV Cells: Theory of solar PV cells. Solar PV cell materials, solar PV array, solar PV power plant, limitations of solar PV. Types of PV power plants (Stand alone & Grid connected)

UNIT III FUEL CELLS AND WIND ENERGY 9

Fuel Cells: Principle of working of various types of fuel cells, performance and limitations. Wind power and its sources, site selection, Types of WECS, Based on turbine VAT Turbine, HAT Turbine, Based on Power Delivery: Stand alone & Grid connected. Performance and limitations of energy conversion systems.

UNIT IV GEOTHERMAL ENERGY & HYDRO POWER PLANT 9

Geothermal Energy: Sources of geothermal energy, geothermal Power plant, environmental considerations. Essential components of Hydroelectric Systems,

Classification of Hydro power schemes, Turbine theory, classification of water turbine.

UNIT V BIO-MASS AND OCEAN ENERGY 9

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Energy: Principle of working, performance and limitations.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Describe the significance of various renewable energy resources and Energy storage technology.

CO2: Discuss on materials, types and applications of solar PV and Thermal energy storage system.

CO3: Describe the principle of working & types of fuel cells & WECS.

CO4: Discuss on geothermal energy and hydro power plant.

CO5: Illustrate the utilization of other energy sources such as biogas and Ocean energy.

TEXT BOOKS:

1. Khan, B.H., 2006. *Non-conventional energy resources*. Tata McGraw-Hill Education.

REFERENCES:

1. Rai, G.D., 2011. A Text book of Non-conventional energy Sources.
2. Twidell, J. and Weir, T., 2015. *Renewable energy resources*. Routledge.

OEE155	SOFT COMPUTING TECHNIQUES AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of soft computing techniques
- To describe the artificial neural network and its applications
- To explain the basics of fuzzy logic and its applications.
- To solve single objective optimisation problems using GAs.
- To analyse the features of hybrid control schemes.

UNIT I INTRODUCTION TO SOFT COMPUTING 9

Concept of computing systems – Soft computing vs Hard computing – Characteristics of soft computing – Some applications of soft computing techniques.

UNIT II ARTIFICIAL NEURAL NETWORK 9

Review of fundamentals – Biological neuron, artificial neuron, activation function, single layer perceptron – Limitation – Multi layer perceptron – Back Propagation Algorithm (BPA) – Recurrent Neural Network (RNN) – Adaptive Resonance Theory (ART) based network – Radial basis function network – online learning algorithms, BP through time – Real Time Recurrent Learning algorithms – Reinforcement learning - Neural Network based controller.

UNIT III FUZZY LOGIC 9

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Fuzzy membership functions - Defuzzification – Fuzzy logic controller – Familiarization with fuzzy logic toolbox – Fuzzy logic application – A typical case study.

UNIT IV GENETIC ALGORITHMS 9

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques – Basic GA framework and different GA architectures – GA operators: Encoding, Crossover, Selection, Mutation, etc. – Solving single-objective optimization problems using GAs.

UNIT V HYBRID CONTROL SCHEMES 9

Fuzzification and rule base using ANN – Neuro fuzzy systems – ANFIS – Fuzzy neuron– GA – Optimization of membership function and rule base using Genetic Algorithm – Introduction to other evolutionary optimization techniques, support vector machine– Case study – Familiarization with ANFIS toolbox – Applications of hybrid systems to engineering problems.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1: Differentiate between soft and hard computing techniques.

CO2: Understand the basics of artificial neural network.

CO3: Interpret fuzzy logic model for a given system.

CO4: Construct genetic algorithm for single objective optimisation problem.

CO5: Acquire knowledge on hybrid control

REFERENCES:

1. Laurence Fausett, *"Fundamentals of Neural Networks"*, Prentice Hall, Englewood Cliffs, N.J., 1992
2. Timothy J. Ross, "*Fuzzy Logic with Engineering Applications"*, McGraw Hill Inc., 2000.
3. Goldberg, "*Genetic Algorithm in Search, Optimization and Machine learning*", Addison Wesley Publishing Company Inc. 1989
4. Millon W.T., Sutton R.S. and Webrose P.J., "*Neural Networks for Control*",

MIT press, 1992
5. Ethem Alpaydin, "*Introduction to Machine learning (Adaptive Computation and Machine Learning series)*', MIT Press, Second Edition, 2010.
6. Zhang Huaguang and Liu Derong, "*Fuzzy Modeling and Fuzzy Control Series: Control Engineering*", 2006

Suggestions and Recommendations received from the Members:

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli suggested to include Biosensors in the Bio Electronics course as it would be very helpful for the students opting it.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli questioned on the necessity for a CSE, IT or AI & DS student to opt for Control system Analysis. Dr. Sudalaimani explained that it would be very essential and useful when students integrate a hardware and control it through a computer.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli asked, whether the renewable energy sources open elective is similar to that offered to EEE students. Dr. Prince Winston informed that it is not.

BoS members suggested to offer Green Building course for Civil Engineering students also.

For all other open elective courses, all the BoS members were approved the syllabus.

Item No: 003.05.00

Presentation of Electrical and Computer Engineering – Curriculum and Suggestions regarding implementation of common curriculum for the current First Year (2021-2022 Enrolled Students)

Dr. S. Kalyani, Professor, Department of Electrical and Electronics Engineering and Controller of Examinations presented the detailed curriculum of

Electrical and Computer Engineering and the pre BoS meeting discussion regarding this curriculum design.

The following curriculum design for the first year and higher semester is proposed and suggestions were invited from the BoS members.

Sl. No.	Category of Courses	Credits
1.	**Foundation Courses** (Humanities and Social Sciences including Management Courses, Basic Science and Engineering Science Courses)	60
2.	**Professional Core Courses**	60
3.	**Professional Elective Courses**	18
4.	**Open Elective Courses**	9
5.	**Employability Enhancement Courses**	27
6.	**Online Courses**	6
7.	**Audit Courses***	---

***Note:** Audit Courses such as Life Science, Indian History, Motivational programmes, etc., shall be introduced as it mandates the requirement of Outcome Based Education.

SEMESTER I

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	SH101	Technical English	3	0	0	3
2	MA101	Matrices and Differential Calculus	3	0	0	3
3	PH101	Engineering Physics	3	0	0	3
4	GE101	Principles of Engineering	3	1	0	4
5	EM101	Coding Techniques - I	3	0	0	3

6	GE102	Biology for Engineers	3	0	0	3
Practicals						
7	MA102	Mathematics Laboratory (using MATLAB)	0	0	3	1
8	PH102	Physics Laboratory	0	0	3	1
9	EM102	Coding Techniques - I Laboratory	0	0	3	1
Total Credits			18	1	9	22

SEMESTER II

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	SH151	Technical Communication Skill Development	3	0	2	4
2	MA151	Vector Calculus and Laplace Transforms	3	0	0	3
3	CY151	Engineering Chemistry	3	0	0	3
4	GE151	Design Thinking	3	0	0	3
5	EM151	Coding Techniques - II	3	0	0	3
6	GE152	Engineering Graphics	3	0	2	4
Practicals						
7	GE153	MATLAB & LabVIEW Simulation Laboratory	0	0	4	2
8	CY152	Chemistry Laboratory	0	0	3	1
9	EM152	Coding Techniques – II Laboratory	0	0	3	1
Total Credits			18	0	14	24

SEMESTER III

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	MA201	Multivariate Calculus and Linear Algebra	3	1	0	4
2	EE201	Electromagnetic Theory	3	0	0	3
3	GE201	Environmental Engineering and Science	3	0	0	3
4	EE202	Data Structures and Algorithms	3	0	0	3
5	EE203	Circuit Theory	3	0	0	3
6	EE204	Structure and Design of Digital Systems	3	0	0	3
Practicals						
7	EE205	Digital Systems Laboratory	0	0	4	2
8	EE206	Data Structures and Algorithms Laboratory	0	0	3	1
9	EE207	Electric Circuits Laboratory	0	0	4	2
Total Credits			18	1	11	24

SEMESTER IV

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	MA251	Numerical Methods for Electrical Engineering	3	1	0	4
2	EE251	Electronic Devices	3	0	0	3
3	EE252	Electrical Machines	3	0	0	3
4	EE253	Computer Architecture	3	0	0	3
5	EE7XX	Open Elective - I	3	0	0	3
6	EE254	Control Systems	3	0	0	3

Practicals						
7	EE255	Electrical Machines Laboratory	0	0	4	2
8	EE256	Control Systems Laboratory	0	0	3	1
9	EM251	Internship / Practical Training / Value Added Courses	0	0	3	3
Total Credits			18	1	10	25

SEMESTER V

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	MA301	Mathematical Concepts for Data Analytics	3	0	0	3
2	EE301	Linear Integrated Circuits	3	0	0	3
3	EE7XX	Open Elective – II	3	0	0	3
4	EE302	Microprocessors and Microcontrollers	3	0	0	3
5	EE9XX	Elective I	3	0	0	3
6	EE9XX	Elective II	3	0	0	3
Practicals						
7	EE303	Circuits and Devices Laboratory	0	0	3	1
8	EE304	Microprocessors and Microcontrollers Laboratory	0	0	4	2
9	EM301	Value Added Course(s)	2	0	0	2
Total Credits			20	0	7	23

SEMESTER VI

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C

Theory						
1	MA351	Forecasting Methods and Applications	3	0	0	3
2	EE351	Applied Power Electronics	3	0	2	4
3	EE352	Sensors Systems and Techniques	3	0	0	3
4	EE7XX	Open Elective – III	3	0	0	3
5	EE9XX	Elective III	3	0	0	3
6	EE9XX	Elective IV	3	0	0	3
7	EE8XX	Online Course - I	3	0	0	3
Practicals						
7	MA352	Data Analytics Laboratory	0	0	3	1
8	EM351	Skill Development in IoT / Value Added Courses	1	0	2	2
Total Credits			22	0	7	25

SEMESTER VII

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	EE401	Machine Learning Techniques in Electrical Engineering	3	0	0	3
2	EE402	Measurements and Instrumentation	3	0	0	3
3	EE403	Device Modelling	3	0	0	3
4	EE9XX	Elective V	3	0	0	3
5	EE9XX	Elective VI	3	0	0	3
6	GE351	Professional Ethics	3	0	0	3
Practicals						
7	EE404	Applied Machine Learning Laboratory	0	0	4	2
8	EE405	Instrumentation Laboratory	0	0	4	2

9	EM401	Project Phase - I	0	0	8	4
Total Credits			18	0	16	26

SEMESTER VIII

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	EE8XX	Online Course - II	3	0	0	3
Practicals						
2	EM451	Project Phase - II	0	0	16	8
Total Credits			3	0	16	11

The number of credits (totaling to 180) in each semester is summarized as follows:

Course	I	II	III	IV	V	VI	VII	VIII
B.E. Electrical and Computer Engineering	22	24	24	25	23	25	26	11

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, had discussed regarding the eligibility criteria for higher studies and government job.

He also pointed out to refer the curriculum of B.E. Electrical and Computer Engineering of various institution/universities who is offering the same programme.

Er. R. V. Prathiba, Research Scholar, Department of EEE, Thiagarajar College of Engineering, Madurai said that the course curriculum is well framed

and agreed the words of Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli.

Overall the BoS members appreciated the effort taken by the department and college management towards the starting of new program and approved the new curriculum of B.E. Electrical and Computer Engineering to proceed with the AICTE approval process.

Item No: 003.06.00

Presentation of First year common curriculum for all Departments which will be followed from the current academic year 2021-2022

Dr. S. Kalyani, Professor, Department of Electrical and Electronics Engineering and Controller of Examinations Presented First year common curriculum for all Departments which will be followed from the current academic year 2021-2022. It will come under new Regulations 2021.

The following curriculum design for the first year was proposed and suggestions were invited from the BoS members.

SEMESTER I

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	SH101	Technical English	3	0	0	3
2	MA101	Matrices and DifferentialCalculus	3	0	0	3
3	PH101	Engineering Physics	3	0	0	3
4	GE101	Principles of Engineering	3	1	0	4
5	EM101	Coding Techniques - I	3	0	0	3
6	GE102	Biology for Engineers	3	0	0	3
Practicals						

7	MA102	Mathematics Laboratory(using MATLAB)	0	0	3	1
8	PH102	Physics Laboratory	0	0	3	1
9	EM102	Coding Techniques - ILaboratory	0	0	3	1
Total Credits			18	1	9	22

SEMESTER II

Sl.No	Course Code	Course Name	Credits			
			L	T	P	C
Theory						
1	SH151	Technical CommunicationSkill Development	3	0	2	4
2	MA151	Vector Calculus andLaplace Transforms	3	0	0	3
3	CY151	Engineering Chemistry	3	0	0	3
4	GE151	Design Thinking	3	0	0	3
5	EM151	Coding Techniques - II	3	0	0	3
6	GE152	Engineering Graphics	3	0	2	4
Practicals						
7	GE153	MATLAB & LabVIEW Simulation Laboratory	0	0	4	2
8	CY152	Chemistry Laboratory	0	0	3	1
9	EM152	Coding Techniques – IILaboratory	0	0	3	1
Total Credits			18	0	14	24

BoS members expressed the concern on time constraints to implement the first year common curriculum. Also members approved the common curriculum of all UG programmes under R2021.

Item No: 003.07.00 - 003.12.00

Modification/Ratifications in II year syllabus; UG: Electrical Engineering Laboratory

Dr. B. Guru Barthik Babu, Assistant Professor, Department of Electrical and Electronics Engineering presented the modified syllabus for EE1317-Electrical Engineering Laboratory (3rd semester Mechanical Engineering). He also presented the List of online NPTEL courses, Assessment methodology - Industry institute interaction, Value added courses and Skill development courses.

EE1317	ELECTRICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To demonstrate the operation of DC drives, AC drives and transformers and give them experimental skill.
- To study the different types of DC and AC starters.

LIST OF EXPERIMENTS

1. O.C.C & Load characteristics of DC self-excited Shunt generator
2. Load test on DC Series motor
3. Load test on DC Compound motor
4. Speed control of DC Shunt motor (Armature, Field control)
5. O.C & S.C test on a single phase transformer
6. No-load and blocked rotor test on single phase Induction Motor
7. Load test on three phase squirrel cage Induction motor
8. No-load and blocked rotor test on three phase Induction Motor
9. Speed control of three phase slip ring Induction Motor
10. Study of DC & AC Starters

TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of this course, the students will be able to

CO1: Analyze the various characteristics and testing of DC Generator
CO2: Analyze the various characteristics and testing of DC Motor
CO3: Evaluate the performance of single phase Transformer.
CO4: Perform load test on Induction motors.
CO5: Illustrate the use of DC and AC starters.

- **EE1317 Electrical Engineering Laboratory**

BoS external/internal members approved the amendments in syllabus.

PG: Open Elective courses can be offered either in II Semester or III Semester for M.E.

Dr. D. Prince Winston requested the approval for offering the open electives of M.E., Power Systems Engineering in 2nd semester or 3rd semester. BoS members approved the same.

He also requested the approval for offering the online course for M.E., Power Systems Engineering from 1st Semester onwards based on prior approval of three member committee. BoS members approved the same.

Discussion and approval of List of online NPTEL courses

List of online NPTEL courses

January to April NPTEL Courses – UG

S. No.	Course Name	Course Code
1	Principles of Signals and Systems	noc20-ee15
2	Signals and Systems	noc20-ee06
3	Principles of Communication Systems - I	noc20-ee16
4	Principles of Digital Communication	noc20-ee17
5	Discrete Time Signal Processing	noc20-ee31
6	Multirate DSP	noc20-ee21
7	Fundamentals of MIMO Wireless Communication	noc20-ee33
8	Spread Spectrum Communications and Jamming	noc20-ee34
9	Evolution of Air Interface towards 5G	noc20-ee36
10	Integrated Circuits, MOSFETs, OP-Amps and their Applications	noc20-ee13
11	Network Analysis	noc20-ee46
12	Analog Circuits	noc20-ee24
13	Analog Circuits	noc20-ee27
14	Analog Electronic Circuits	noc20-ee45

S. No.	Course Name	Course Code
15	Analog Circuits and Systems through SPICE Simulation	noc20-ee30
16	Digital Electronic Circuits	noc20-ee32
17	Electronics equipment integration and Prototype building	noc20-ee01
18	High Power Multilevel Converters- Analysis, design and operational issues	noc20-ee02
19	Advance power electronics and Control	noc20-ee28
20	Recent Advances in Transmission Insulator	noc20-ee43
21	Antennas	noc20-ee20
22	Basic Building Blocks of Microwave Engineering & Design Principles of RF and Microwave Filters and Amplifiers	noc20-ee35
23	Microwave Integrated Circuits	noc20-ee25
24	Fundamentals of semiconductor devices	noc20-bt17
25	Analog IC Design	noc20-ee26
26	Digital IC Design	noc20-ee05
27	Architectural Design of Digital Integrated Circuits	noc20-ee37
28	CMOS Digital VLSI Design	noc20-ee29
29	VLSI Signal Processing	noc20-ee44
30	Microprocessors And Microcontrollers	noc20-ee42
31	Microprocessors and Interfacing	noc20-ee11
32	Power Management Integrated Circuits	noc20-ee08

July to December NPTEL Courses – UG

S.No.	Course Name	Duration
1	Fabrication Techniques for MEMs-based sensors : clinical perspective	noc21-ee60
2	Op-Amp Practical Applications: Design, Simulation and Implementation	noc21-ee61
3	Design of photovoltaic systems	noc21-ee62
4	Advances in UHV Transmission and Distribution	noc21-ee63
5	Principles of Modern CDMA/ MIMO/ OFDM Wireless Communications	noc21-ee64

S.No.	Course Name	Duration
6	Principles of Communication Systems: Part - II	noc21-ee65
7	Control engineering	noc21-ee67
8	Introduction to Smart Grid	noc21-ee68
9	Electrical Distribution System Analysis	noc21-ee69
10	Advanced Linear Continuous Control Systems: Applications with MATLAB Programming and Simulink	noc21-ee70
11	Electrical Machines - I	noc21-ee71
12	Microwave Theory and Techniques	noc21-ee72
13	Fundamentals of Electrical Engineering	noc21-ee73
14	Analog communication	noc21-ee74
15	Digital Circuits	noc21-ee75
16	Power system analysis	noc21-ee77
17	Digital Image Processing	noc21-ee78
18	Pattern Recognition and Application	noc21-ee79
19	Semiconductor Devices and Circuits	noc21-ee80
20	Optical Engineering	noc21-ee81
21	Applied Electromagnetics For Engineers	noc21-ee82
22	Electromagnetic Theory	noc21-ee83
23	Microelectronics: Devices To Circuits	noc21-ee86
24	Introduction to Photonics	noc21-ee87
25	Microwave Engineering	noc21-ee88
26	Analog Electronic Circuits	noc21-ee89
27	Enclosure design of electronics equipment	noc21-ee90
28	Digital Switching - I	noc21-ee94
29	Basics of software defined Radios and Practical Applications	noc21-ee95

S.No.	Course Name	Duration
30	System Design Through VERILOG	noc21-ee97
31	Integrated Photonics Devices and Circuits	noc21-ee98
32	Basic Electrical Circuits	noc21-ee99
33	Introduction to Semiconductor Devices	noc21-ee59
34	Image Signal Processing	noc21-ee100
35	Introductory Neuroscience & Neuro-Instrumentation	noc21-ee101
36	Power Quality	noc21-ee103
37	Control and Tuning Methods in Switched Mode Power Converters	noc21-ee104
38	Mathematical Aspects of Biomedical Electronic System Design	noc21-ee105
39	Electrical Measurement and Electronic Instruments	noc21-ee107
40	Principles and Techniques of Modern Radar Systems	noc21-ee108
41	Power System Protection	noc21-ee109
42	Power System Protection and Switchgear	noc21-ee110
43	Advanced Microwave Guided-Structures and Analysis	noc21-ee111
44	Electric vehicles and Renewable energy	noc21-ee112
45	Linear Systems Theory	noc21-ee113
46	Fiber Optic Communication Technology	noc21-ee114

January to April NPTEL Courses–PG

S. No.	Course Name	Duration
1.	Mathematical Methods and Techniques in Signal Processing	noc20-ee51
2.	Statistical Signal Processing	noc20-ee53
3.	Transmission lines and electromagnetic waves	noc20-ee04
4.	Power Quality Improvement Technique	noc20-ee10
5.	Linear Dynamical Systems	noc20-ee47

6.	Nonlinear Adaptive Control	noc20-ee19
7.	A brief introduction of Micro - Sensors	noc20-ee52

July to December NPTEL Courses – PG

S.No.	Course Name	Duration
1.	Introduction to Wireless and Cellular Communications	noc21-ee66
2.	Millimeter Wave Technology	noc21-ee76
3.	Design for internet of things	noc21-ee85
4.	Computational Electromagnetics	noc21-ee91
5.	Probability Foundations for Electrical Engineers	noc21-ee92
6.	Stochastic Modeling and the Theory of Queues	noc21-ee93
7.	Dc Microgrid and Control System	noc21-ee96
8.	Signal Processing for mm Wave communication for 5G and beyond	noc21-ee102
9.	Concentration inequalities	noc21-ee106

Suggestions and Recommendations received from the Members:

Dr. Gurukarthik babu requested the suggestions of BoS members on whether the online course can be given from 5th Semester. The BoS members accepted the request, but informed to ensure that the student completes the pre-requisite (the basic courses) before choosing a NPTEL Course.

The BoS members went through the list of courses and suggested to remove the courses which the students have already taken up in our curriculum. Dr. Prince Winston assured to remove the courses that are repetitive in NPTEL list.

All the BoS members approved the NPTEL Course list and further addition of any new NPTEL courses with the prior approval of three member committee and Head of the Department.

Assessment methodology - Industry institute interaction

Suggestions and Recommendations received from the Members:

Dr. Gurukarthik Babu requested the BoS members' suggestions on the assessment methodology for students' interaction with industry through internships. He presented that the methodology to be followed is presentation by students and oral viva questions with the prior approval of three member committee and Head of the Department.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, He enquired on the credits for internship. It was informed that there are no credits as of now, but it will be printed in their grade sheets. Dr. Simon informed that, presentation and Oral Viva is fine.

List of Value added courses

S.no.	List of Value added courses	Duration	Organisation offering it
1	Solar Technology	30 hours	Sree Minniyal Pvt. Ltd.
2	Industrial safety aspects and detailed understanding	30 hours	Brainwave consultant, Chennai
3	Electric Vehicles	30 hours	Power Project, Chennai
4	Internet of Things	30 hours	Quantanics Techserve pvt. Ltd.
5	Realtime application development using LabVIEW	30 hours	KCET

Suggestions and Recommendations received from the Members:

The external BoS members asked whether certificates will be offered at the end of such value added courses. They also suggested to ensure the quality of the program and the validity, credibility of the certificate before starting the course. It was also suggested to ensure that the aforementioned training companies are certified by ISO.

All the BoS members approved the value added Course list and further addition of any new courses with the prior approval of three member committee and Head of the Department.

Skill development courses

SDCE01 **Practical Course on Solar PV Systems**

15 HOURS

Objective

- To train the students in Solar PV Systems and technologies.
- To provide adequate inputs on a variety of issues in harnessing Solar PV Systems.
- To recognize current and possible future role of Solar PV Systems.

Theory **5 Hours**

- Global overview of Renewable Energy Development including Solar
- National overview of Power Development
- National overview of Renewable Energy Development including Solar
- The Need of Solar Power, Benefits, Application of Solar Energy
- Basics on solar energy and power generation systems.
- Basic principles of Solar Photovoltaic
- Manufacturing process for Solar Photovoltaic
- Use and handling procedure of solar panels, energy storage, control and conversion
- Basic electrical system and functioning of various electrical devices
- AC and DC Supply essentials
- Components of Solar PV Systems
- Maintenance procedure of equipment
- Site survey, design and evaluation of various parameters
- Tools involved in installation of system

Practical **10 Hours**

Hands on Training in:

1. Testing of Solar PV Cells (2 Hours)
2. Testing of Solar PV Panels to Identify Various Faults (2 Hours)

3. Testing of Solar PV Arrays (2 Hours)
4. Installation of Standalone Solar PV Systems (2 Hours)
5. Installation of Grid Connected Solar PV Systems (2 Hours)

OUTCOMES:

At the end of the course, the learner will be able to:

CO1: Understand and analyze Solar PV Systems.

CO2: Simulate and test the various Solar PV Systems

CO3: Recognize current and possible future role of Solar PV Systems.

CO4: Understand basics of Intelligent Controllers of Solar PV Systems.

CO5: Analyze the Solar PV systems to improve and optimize its performance.

REFERENCE BOOKS:

1. Solanki, C.S., 2015. *Solar photovoltaics: fundamentals, technologies and applications*. Phi learning pvt. Ltd..
2. Pearsall, N. ed., 2016. *The performance of photovoltaic (PV) systems: modelling, measurement and assessment*. Woodhead Publishing.
3. Prasad, D. and Snow, M., 2014. *Designing with solar power: a source book for building integrated photovoltaics (BiPV)*. Routledge.

SDCE02 Practical Course on Electrical Energy Audit

15 HOURS

Objective

- To identify energy savings opportunities and estimate the costs and benefits of energy efficiency improvements.
- To expose the students to how much energy is being used by a facility and can be used to benchmark energy use.

Theory **5 Hours**

- Basic of Electrical Energy

- TNEB Tariff Systems
- How to Read Electrical Energy Bills - Houses/Industries
- Introduction to Various Electrical Equipment with Energy Saving Aspect
- Introduction to Measuring Instruments used for Electrical Energy Audit

Practical **10 Hours**

Real time Energy Audit of:

1. Two 500kVA Distribution Transformers (2 Hours)
2. 5HP Induction Motor (2 Hours)
3. Lighting Loads (LED, FL) Located at Particular Area (2 Hours)
4. Induction Motor Drive with respect to Power Quality (1 Hours)
5. Automatic Power Factor Controller / Static Capacitor Banks (2 Hours)
6. Case Study - Demand Reduction for Industries (1 Hours)

OUTCOMES:

At the end of the course, the learner will be able to:

CO1: Interpret energy conservation policies in India.

CO2: Implement energy conservation techniques in electrical machines.

CO3: Apply energy conservation techniques in electrical installations.

CO4: Use Co-generation and relevant tariff for reducing losses in facilities.

CO5: Carryout energy audit for electrical system.

REFERENCE BOOKS:

1. Krarti, M., 2020. *Energy audit of building systems: an engineering approach*. CRC press.
2. Desai, S., 2015. *Handbook of Energy Audit*. McGraw-Hill Education

SDCE03 Practical Course on Electronic Product Development

15 HOURS

Objective

- To impart knowledge on PCB Machine such as Design, Layout and printing
- To expose the students to the operation of Arduino Controller & Various Sensors and give them experimental skill

Theory **3 Hours**

- Basic of PCB Design
- Introduction to PCB Machine
- Introduction to Arduino Controller
- Introduction to Various Sensors

Practical **12 Hours**

Design and Development of:

1. PCB Board for 5V DC Power Supply - using Manual method (2 Hours)
2. PCB Board for 5V DC Power Supply - using PCB Machine (2 Hours)
3. Product for water level indication (2 Hours)
4. Product for protect the motor/electrical equipment (2 Hours)
5. 12V DC – 12V AC Square Wave Inverter (2 Hours)
6. 12V DC Step Down DC Chopper (2 Hours)

OUTCOMES:

At the end of the course, the learner will be able to:

CO1: Understand and develop the basic PCB design

CO2: Develop basic PCB design in the PCB Board by using manual and using PCB machine.

CO3: Model and analyze Arduino Controller and their application to Real time

CO4: Implement the simple applications using Sensors.

REFERENCE BOOKS:

1. Archambeault, B.R. and Drewniak, J., 2013. *PCB design for real-world EMI control* (Vol. 696). Springer Science & Business Media.
2. Norris, D., 2015. *The Internet of things: do-it-yourself projects with Arduino, Raspberry Pi, and BeagleBone Black*. McGraw-Hill Education TAB.
3. Fraden, J. and Fraden, J., 2004. *Handbook of modern sensors: physics, designs, and applications* (Vol. 3). New York, NY, USA:: springer.

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, wanted to confirm whether the Skill development courses are conducted without any additional fee. It was replied that no fees will be collected for these skill development courses. BoS members approved the syllabus.

Item No: 003.13.00 – 003.13.02

Discussion of new amendment introduced by Anna University to its affiliated colleges, Amendment introduced in passing criteria and Exam pattern for I & II year – physical mode (descriptive type).

Dr. D. Prince Winston, Professor and HoD (Department of Electrical and Electronics Engineering) presented the new amendment introduced by Anna University to its affiliated colleges, Amendment introduced in passing criteria and Exam pattern for I & II year – physical mode (descriptive type).

Suggestions and Recommendations received from the Members:

Dr. Sishaj P. Simon, Associate Professor, Department of Electrical and Electronics Engineering, National Institute of Technology, Tiruchirappalli, accepted that it has to be followed as it is the direction from the affiliated, Anna University, Chennai

Item No: 003.14.00 - 003.14.01

Results of previous examination and department progress

Dr. D. Prince Winston, Professor and HoD (Department of Electrical and Electronics Engineering) presented the results of previous semester examination and department progress report for the past one year.

Item No: 003.15.00

Dr. D. Prince Winston, Professor and HoD (Department of Electrical and Electronics Engineering) informed that the next BoS meeting can be conducted tentatively during May 2022.

Item No: 003.16.00

Vote of thanks

Mr. A. Karthikeyan, Assistant Professor, EEE, Kamaraj College of Engineering and Technology, proposed vote of thanks to all the external and internal experts and the meeting adjourned.

Resolution made based on the discussions made with the BoS Members:

EE1501 Power System Analysis

RESOLVED TO NOTE to include SMIB system in stability analysis

EE1571 Control Systems

RESOLVED TO NOTE to give assignments using MATLAB software.

EE1572 Microprocessors and Microcontrollers

RESOLVED TO RECOMMEND to include Embedded C syllabus in Unit IV and Arduino and its applications may combine as a single unit as Unit V.

EE1581 Microprocessors and Microcontrollers Laboratory

RESOLVED TO RECOMMEND to include experiments based on Embedded C programming and to reduce the experiments in 8085 since it is obsolete.

EE1601 Power Electronics and Drives

RESOLVED TO RECOMMEND to include the topic titled "Introduction to BLDC motor drive" in Unit V.

EE1603 Renewable Energy Systems

RESOLVED TO SUGGEST to include SOLANKI, C. S. (2015). Solar Photovoltaics: Fundamentals, Technologies and Applications. India: PHI Learning in one of the reference Books.

EE1671 Digital Signal Processing

RESOLVED TO SUGGEST to give programming or simulation assignments using MATLAB software.

EE1611 Power Electronics and Drives Laboratory

RESOLVED TO RECOMMEND to include the experiments on AC and DC Drives.

EE1612 Renewable Energy Systems Laboratory

RESOLVED TO NOTE to remove fuel cell rating in experiment number 10.

EE1531 Design of Electrical Apparatus

RESOLVED TO NOTE the syllabus of the computer programming in each unit as the syllabus is lengthy.

EE1532 Internet of Things and Its Applications

RESOLVED TO NOTE the weightage given for unit 5 is more.

RESOLVED TO NOTE to have mini project in unit 5 to build some IoT projects.

EE1533 Machine Learning Algorithm for Electrical Engineering

RESOLVED TO CONSIDER to change the title as Machine Learning Applications for Electrical Engineering'.

EE1534 Power System Transients

RESOLVED TO NOTE to have the IEC standards for each unit for practical understanding of the subject.

OEE151 Bio Electronics

RESOLVED TO RECOMMEND having Biosensors in Bio Electronics Course.

OEE153 Green Building

RESOLVED TO CONSIDER offering Green Building course to Civil Engineering students

The 3rd Board of Studies (EEE Board) of Kamaraj College of Engineering, Virudhunagar, was held on 13.11.2021, 10.00 am through online mode. The minutes of the meeting is approved by the BoS members.

Name of the Members	Signature
Dr. M. Saravanan Professor, Department of EEE, Thiagarajar College of Engineering, Madurai.	M. Sara 19.11.2021
Dr. Sishaj P Simon Associate Professor, Department of EEE, National Institute of Technology, Trichy.	SPS 19.11.2021
Dr. S. Jeevananthan Professor, Department of EEE, Pondicherry Engineering College, Pondicherry.	
Dr. K. Janakiraman Head – Technical M/s. OBO BETTERMANN India Pvt. Ltd., Chennai	
Er. R.V. Prathiba Research Scholar, Department of EEE, Thiagarajar College of Engineering, Madurai.	R.V. Prathiba

BoS coordinators

K. GANESAN

A. KARTHIKEYAN.

(DR. D. PRINCE WINSTON)
Professor & Head / EEE
Chairman, BoS (EEE Board)

KAMARAJ®

COLLEGE OF ENGINEERING & TECHNOLOGY

(**An Autonomous Institution** - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C. Nagar, K.Vellakulam – 625 701 (Near **VIRUDHUNAGAR**).

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Faculty Name List

S.No.	Staff Name	Designation	
1.	Dr.D.Prince Winston	Prof. & HoD/EEE	
2.	Dr.S.Kalyani	Prof.	
3.	Dr.M .Sudalaimani	Asst. Prof	
4.	Dr.B.Guru Karthik Babu	Asst. Prof	
5.	Dr. J.Jeslin Drusila Nesamalar	Asst. Prof	
6.	Mrs. B. Noorul Hamitha	Asst. Prof	
7.	Mrs.V.Chandra	Asst. Prof	
8.	Mr.A.Azarudeen	Asst. Prof	
9.	Mr. R.Ganesan	Asst. Prof	
10.	Mr.D.Mariappan	Asst. Prof	
11.	Mr. K.Ganesan	Asst. Prof	
12.	Mr.A.Karthikayan	Asst. Prof	
13.	Mr. S.Jegan	Asst. Prof	
14.	Mrs. S.Vimala Devi	Asst. Prof	
15	Mr.T.Hari Prasath	Asst. Prof	
16.	Mrs.R.Reenu	Asst. Prof	

HoD/EEE