1.4.2 How the feedback obtained is being analysed and utilized for overall development of the institution?

Collected curriculum feedback is represented through the Board of Studies Members (BOS) and syllabus framing committee members. Based on the Institutional Hierarchical Framework, Feedback can be broadly classified in to two levels

- The department level feedback that are discussed in the department meeting and necessary initiatives and measures that are taken with the consent of the principal.
- The college level feedback analyzed by the Academic Council Members (ACM) headed by the principal. On a regular basis our Institute connects with all its stake holders to collect feedback to utilize them for overall development of the institution.

Different types of Feedback taken throughout the Academic Year with Stakeholders given as follows: Feedback is collected from the following groups identified as stakeholders

1. Current students
2. Alumni
3. Faculty
4. Parents
5. Employers

Based on the inputs taken from the Stake holders, the data is processed. Below is the action taken on the feedback for the Academic year **2019-20**

S.no	Stakeholder	Feedback	Action taken	Page No
1	**Student**	Requested to send students to training programmes to get hands-on sessions	As per the feedback from alumni and students MOOC's/Training/Internships-1, 2, 3 are made mandatory in R-20 scheme to expose students to the industry.	5-7
	Alumni	Suggested to make Industrial Internships mandatory in every year to make comfortable with the Industrial environment		
2	**Student**	Requested to modify Signals & Systems course as the GATE syllabus	To meet the requirements of the GATE, Signals and Systems theory course is introduced in semester VII of R-18 scheme	8-9
3	**Student**	Suggested to modify Digital Signal Processing & Embedded Systems course to Digital Signal processing course by removing Embedded systems topics	From R-16 syllabus of Digital Signal Processing and Embedded Systems which was a core course was modified as Digital Signal	10-14

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			Processing(elective)	
4	**Alumni**	Suggested to add a course that will give a brief idea of industrial Systems and Equipment.	Based on the suggestions from the alumni, to get students the basic idea on Components, Equipment and Designing of the circuits in Industries the course Industrial Electrical System is introduced in R-18 scheme	15-17
5	**Employer**	Suggested to add a course on Electrical Vehicles	To familiarise advanced technologies in e-Mobility sector a new course named Electrical Hybrid vehicles introduced in semester VI of R-18 scheme	18-20
	Alumni	Insisted to add a course on present trending e-Mobility		
6	**Alumni**	Suggested to add Advanced Protection topics in Power Systems Protection	Switch Gear Protection (R-16) course is modified as Power System Protection(R-18)- 80 % of Switch Gear and Protection and 20 % new syllabus added on Numerical Relays	21-25
7	**Teacher**	Suggested minor changes in Wave, Optics and introduction to Quantum Mechanics to teach both ECE and EEE	Wave, Optics and Introduction to Quantum Mechanics(R-18) theory course name is changed to Electromagnetic theory & Quantum Mechanics(R-20) with modifications in the contents to teach EEE & ECE students.	26-31
8	**Teacher**	Simulation experiments might have been included in Control Systems Laboratory.	Control Systems – more emphasis on test signals, Controllers, Compensators and introduction to non-linear systems. Control Systems lab-simulation experiments like Stability Analysis, Time domain and Frequency domain analysis on Second order systems, Compensators, State Space Analysis are added to study the practical s systems are added.	32-38
	Employer	Analysis of practical systems in Time domain, Frequency domain and State Space representation with various test signals needed to be included in Control Systems course		
9	**Teacher**	Suggested to include in detail analysis of Electrical Energy production by Wind and Solar Energy and also related issues in Integrating Wind and Solar Energy to the Grid	Wind & Solar Energy Systems – title changed from Non-Conventional energy sources. Wind and Solar energy conversion systems are completely elaborated. Network	39-44

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	Employer	Suggested to add the topics to related to issues in Integration of Renewable energy to the Grid in non-conventional Energy sources	integration issues are added.	
10	**Teacher**	Suggested to applications of AI techniques in AI techniques in Electrical Engineering course	AI Techniques in Electrical Engineering- applications of AI techniques are removed and ANN Paradigms were added	45-49
	Employer	Suggested to add ANN Paradigms in AI Techniques in Electrical engineering course		
11	**Teacher**	Insisted to remove outdated 8086 Microprocessor topics from Microprocessor and Microcontrollers course	Microprocessor course and lab-8086 has been removed and Communication Interfaces added to get knowledge to bring out hardware projects.	50-54
	Employer	Suggested to revise Microprocessor and Microcontrollers course by removing 8086 Microprocessor topics and to add new processors		
12	**Employer**	Suggested to introduce a course on the Energy Conservation and Auditing for getting students the knowledge on energy efficient Conservation techniques used in Energy systems	A new course named Energy Conservation and Auditing is introduced in semester V as an elective of R-18 scheme	55-58
13	**Employer**	Suggested to make familiar to the Electrical Engineering program in the first year itself and also make students Industry ready.	To practically expose newly joined students and familiarize them with the Electrical Engineering concepts and to meet po1-po12, a new course named Engineering Exploration is introduced in sem-I of R-20 scheme	59-61
14	**Employer**	Insisted to add experiments related to relays on Protection of the Power Systems components in Power Systems -II lab	Power Systems Simulation lab (R-16) is changed to Power System II lab with addition of hardware experiments to get the practical knowledge on Different Relays in the semester VII	62-65
15	**Employer**	Insisted to add Biomedical instruments in Electronics Instrumentation and	With the suggestions from the stake holder, standard Biomedical Instruments are	66-71

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		Measurements course	included in Electronic Instrumentation course in semester-VII of R-18 syllabus	

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Scheme of Instructions of III Semester of B.E. – Electrical & Electronics Engineering as per AICTE Model Curriculum 2021-22

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20MTC07	Applied Mathematics	3	1	0	3	40	60	4
2	20 CS C06	Basic Data Structures	2	0	0	3	40	60	2
3	20 EE C03	**Core- 1** Electrical Circuit Analysis	3	0	0	3	40	60	3
4	20 EE C04	**Core- 2** Analog Electronic Circuits	3	1	0	3	40	60	4
5	20 EE C05	**Core- 3** Electrical Measurements and Instrumentation	3	0	0	3	40	60	3
6	20 EE C06	**Core- 4** Signals & System	3	0	0	3	40	60	3
7	20 CE M01	Environmental Science	2	0	0	2	----	50	NC
8	20 EE I01	MOOCs/Training/ Internship	2-3 weeks/90 hours				**40**	**60**	2
PRACTICALS									
9	20 EE C 07	Analog Electronic Circuits Lab	0	0	2	3	50	50	1
10	20 EE C08	Electrical Circuits and Measurements Lab	0	0	2	3	50	50	1
11	20 CS C07	Basic Data Structures Lab	0	0	2	3	50	50	1
		Total	**19**	**2**	**6**	**-**	**430**	**620**	**24**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instructions of IV Semester of B.E. – Electrical & Electronics Engineering as per AICTE Model Curriculum 2021-22

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-IV

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20 EE C09	**Core -5** Digital Electronics	3	0	0	3	40	60	3
2	20 EE C10	**Core -6** Electrical Machines-1	3	0	0	3	40	60	3
3	20 EE C11	**Core -7** Electromagnetic Fields	3	0	0	3	40	60	3
4	20 EE C12	**Core -8** Power Electronics	3	0	0	3	40	60	3
5	20 EE C13	**Core -9 Power systems I**	3	0	0	3	40	60	3
6	20EGM02	Indian Traditional Knowledge	2	0	0	-	----	-	NC
7	20EGM03	Universal Human Values-II: Understanding Harmony	3	0	0	3	40	60	3
PRACTICALS									
8	20 EE C14	Digital Electronics Lab	0	0	2	3	50	50	1
9	20 EE C 15	Electrical Machines-1 Lab	0	0	2	3	50	50	1
10	20 EE C 16	Power Electronics Lab	0	0	2	3	50	50	1
		Total	**20**	**0**	**6**	**-**	**390**	**510**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instructions of V Semester of B.E. – Electrical & Electronics Engineering as per AICTE Model Curriculum 2022-23

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
THEORY									
1	20 EE C17	**Core – 10** Electrical Machines-II	3	0	0	3	40	60	3
2	20 EE C18	**Core -11** Switchgear and Protection	3	0	0	3	40	60	3
3	20 EE C19	**Core -12** Power Systems -II	3	0	0	3	40	60	3
4	20 EE C20	**Core -13** Control Systems	3	0	0	3	40	60	3
5	20 EE Exx	**PE- I**	3	0	0	3	40	60	3
6	20 EE Exx	**PE-2**	3	0	0	3	40	60	3
7		OE-1	3	0	0	3	40	60	3
8	20 EE I02	Industrial / Rural Internship	3-4 weeks/ **(90)** hours						2
PRACTICALS									
9	20 EE C21	Control Systems Lab	0	0	2	3	50	50	1
10	20 EE C22	Electrical Machines- II Lab	0	0	2	3	50	50	1
11	20 EE C23	Power Systems Lab	0	0	2	3	50	50	1
12	20EGCO3	Employability Skills	0	0	2	3	50	50	1
		Total	**21**	**0**	**8**	**-**	**480**	**620**	**27**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

Program Elective-1	
Course Code	**Title of the Course**
20 EE E11	Electrical Distribution Systems
20 EE E12	Advanced Power Converters
20 EE E13	Simulation Techniques in EE
20 EE E14	Industrial Instrumentation
20 EE E15	Electrical Machine Desigr
20EE E16	Digital Signal Processing

Program Elective-2	
Course Code	**Title of the Course**
20 EE E21	High Voltage Engineering
20 EE E22	Control design for Power Converters
20 EE E23	Optimization Techniques
20 EE E24	Electronic Instruments
	Electrical Machines
	LSI Design

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VII

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC25**	Power System Protection	3	-	-	3	30	70	3
2	**18EEC26**	Electrical Drives	3	-	-	3	30	70	3
3	**18EEC27**	Signals & Systems	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-5	3	-	-	3	30	70	3
5	**18XXOYY**	Open Elective-2	3	-	-	3	30	70	3
PRACTICALS									
6	**18EEC28**	Power Systems-II Lab	-	-	3	3	25	35	1.5
7	**18EEC29**	Electrical Drives Lab	-	-	3	3	25	35	1.5
8	**18EEC30**	Project: Part-1	-	-	4	-	50		2
		Total	**15**	**-**	**10**	**21**	**250**	**420**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-5
18EEE17	Power System Dynamics and Control
18EEE18	Switch Mode Power Converters
18EEE19	Electrical Machine Design
18EEE20	High Voltage Engineering

Course Code	Open Elective-2
18MEO03	Research Methodologies
18MEO04	Entrepreneurship
18EGO01	Technical Writing Skills
18CSO04	Basics of Data Science using R
18CSO07	Basics of Cyber Security

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18EEC27 **SIGNALS AND SYSTEMS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To introduce the concepts of continuous time and discrete time systems and analyse systems in complex frequency domain.
2. To demonstrate sampling theorem and its applications.
3. To elucidate the techniques of Laplace and Z- transforms and their applications on various systems

Course Outcomes: After completion of this course, students will be able to:

1. Understand the basics of signals and systems and classify them
2. Analyse systems in complex frequency domain.
3. Understand sampling theorem and its implications.
4. Explore the applications of Laplace transforms to continuous time systems
5. Apply the Z-transform techniques to discrete time systems

UNIT-I

Introduction to Signals and Systems: Signals and systems as seen in everyday life, in various branches of engineering and science, Signal properties: periodicity, absolute integrability, deterministic and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability and their examples.

UNIT-II

Behaviour of continuous and discrete-time LTI systems: Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems, System representation through differential equations and difference equations, State-space Representation of systems, State-Space Analysis, Multi-input, Multi-output representation, State Transition Matrix and its Role, Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT-III

Fourier Transforms: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients, Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Property of duality in Fourier. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT-IV

Laplace and z- Transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis

UNIT-V

Sampling and Reconstruction: The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects, Relation between continuous and discrete time systems, Introduction to the applications of signal and system theory- Feedback control systems,

Text Books:

1. A.V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Pearson, 2006.

Suggested Reading:

1. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007

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SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E/B.Tech under CBCS
B.E.(EEE)

SEMESTER-VII

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EE C31**	Power System Operation and Control	4	-	3	30	70	4
2.	**16EE C32**	Utilization of Electrical Energy	3	-	3	30	70	3
3.	**16EE C33**	DSP and Embedded Systems	4	-	3	30	70	4
4.	**16EE EXX**	Program Specific Elective- 4	3	-	3	30	70	3
5.	**16XX OYY**	Open Elective-I	3	-	3	30	70	3
PRACTICALS								
6.	**16EE C34**	Power Systems Simulation Lab	0/1	2	3	25	50	2
7.	**16EE C35**	Digital Signal Processor and Embedded Systems Lab`	0/1	2	3	25	50	2
8.	**16EE C36**	Project Seminar	0	3	-	50	-	2
			19	**07**	**-**	**250**	**450**	**23**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-4
16EEE14	Basic VLSI Design
16EEE15	Computer Methods in Power Systems(CMPS)
16EEE16	Power Quality Engineering(PQE)
16EEE17	Special Electrical Machines(SEM)

Course Code	Open Elective-I
16PY O01	History of Science and Technology
16EG O02	Gender Sensitization
16CE O02	Disaster Mitigation and Management (DMM)
16CS O10	Machine Learning Using Phyton
16ME O01	Entrepreneurship

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16EE C31

POWER SYSTEM OPERATION AND CONTROL

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the formulation of Load-Flow problems applying different methods and economic operation of power systems
2. To understand the importance of Load Frequency Control and stability of power systems.
3. To study the reactive power control and basic FACTS controllers

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge in assessing the importance of load flow studies in power system operation. Carryout Load-Flow studies with different methods compare and interpret the results.
2. Acquire knowledge in conducting Economic operation of power system without and with losses
3. Acquire knowledge in conducting Load Frequency Control for single and two area systems and also distinguish between different control methods.
4. Acquire knowledge in analyzing the Stability aspects of power system.
5. Acquire knowledge in assessing the system improvement through reactive power control and FACTS controllers.

UNIT-I

Load Flow Studies: Formulation of Y bus for a system, modeling of tap changing and phase shifting transformer, Formulation of load flow problem, Solution of load flow by Gauss Seidel, Newton- Raphson, Decoupled and Fast Decoupled methods, comparison of different load flow methods.

UNIT-II

Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, B_{mn} Coefficients, Economic operation including transmission losses.

Electric Arc welding: Carbon Arc Welding, Submerged Arc Welding, Atomic Hydrogen Welding.
Resistance Welding: Spot Welding, Seam Welding, Projection Welding, Butt Welding, Flash Butt Welding, Upset Welding, Electron Beam Welding, Laser Welding - Numerical Problems

UNIT-III
Illumination: Introduction, Terms used in illumination, laws of illumination, Polar Curves of C.P. Distribution – Determination of M.S.C.P. and M.H.C.P. from Polar Diagrams- Rousseau's construction, Lighting Schemes- Design of Lighting Schemes- Application to factory lighting, Street lighting and Flood lighting - Numerical Problems

Electric Lamps: Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems - Numerical Problems

UNIT-IV
Electric Traction-I: Introduction, Systems of electric traction and track electrification- DC system, single phase and 3-phase low frequency and high frequency system, composite system, kando system, comparison between AC and DC systems- Train Movement-Typical Speed/Time Curve - Factors affecting scheduled speed - Simplified Speed/Time Curve - Average and Schedule Speed - Tractive Effort for Propulsion of a Train - Power Output from Driving Axles - Energy Output from Driving Axles - Numerical Problems.

UNIT-V
Electric Traction-II: Specific Energy Output - Evaluation of Specific Energy Output - Energy Consumption - Specific Energy Consumption - Adhesive Weight - Coefficient of Adhesion - Mechanism of Train Movement - Numerical Problems

Text Books:
1. C L Wadhwa, Generation, Distribution and Utilization of Electrical Energy- 3 rd Edition New age international publishers, 2015.
2. B.L. Theraja, A Textbook of Electrical Technology Volume-III Transmission and Distribution S. Chand Limited, 23rd Edition, 2013.
3. Partab H, Art and Science of Utilization of Electric power, Dhanpatrai & Sons, 2014

Suggested Reading:
1. J.B.GUPTA, Utilization of Electric Power and Electric Traction- S.K.Kataria & Sons, 2013.
2. R K. Rajput, Utilization of Electrical Power-, 2 nd Edition, Laxmi Publications (p) Ltd, 2016.

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16EE C33

DSP & EMBEDDED SYSTEMS

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:
1. To introduce basic concepts of signals and systems and representation of digital system.
2. To introduce digital signal processor
3. To introduce fundamentals of Real time operation and ARM processor

Course Outcomes: After completion of this course, students will be able to:
1. Identify the digital system and find its response.
2. Design FIR and IIR filter.
3. Be familiar with architecture and features of TMS 320F/2047 DSP.
4. Understand the basic concepts of real time operating systems
5. Be familiar with architecture and features of ARM processor.

UNIT-I
Introduction to signals and systems: Classification of Signals & Systems, Linear shift invariant systems, stability and causality, Sampling of Continuous signals, Signal Reconstruction, quantizing & encoding, linear constant co-efficient difference equations, properties of discrete system- linearity. Analog to digital conversion - Nyquist criteria

UNIT-II
Fourier transforms and filters: Magnitude and phase response discrete time systems - Computation of DFT and IDFT -Properties of Discrete Fourier Transform, - Linear and circular Convolution of sequence using DFT. Fast Fourier transform: Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT. Introduction to IIR Low pass butter worth & Chebyshev digital filters using impulse invariant and bilinear transformation techniques, FIR Rectangular and Kaiserwindows

UNIT-III
DSP Processors: Differences between DSP and other mp architectures,. Basic architectural features, DSP computational building blocks, Bus and Memory

architecture, Address generation unit, speed issues, fixed point DSPs - Architecture of TMS 320C 54X Processor , addressing modes, on-chip peripherals, Real Time operating constraints

UNIT-IV

Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Semaphores and Queues, Hard Real-TimeScheduling Considerations, Host and Target machines, Linker/Locators for Embedded Software.

UNIT-V

Advanced architectures: ARM Processor, memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems

Text Books:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.

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16EE C34

POWER SYSTMES SIMULATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the load flows, transient stability studies, economic load dispatch and load frequency control in power system
2. To understand the time and frequency response of the system
3. To Simulate and compare the output of converters with different loads

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge about Load frequency control
2. Analyse Load flow studies and economic load dispatch
3. Acquire knowledge about transient stability studies
4. Analyse semi, full and buck & boost converters
5. Acquire knowledge about time and frequency response of the system

List of Experiments:

1. Determination of power angle diagram for Salient and Non-salient pole synchronous machine.
2. Frequency response characteristics using Bode plot
3. Root Locus & Nyquist method
4. Design of lag, lead and lag-lead compensator
5. Computation of line parameters
6. Modeling of Transmission Lines
7. Load Flow Studies.
8. Fault Analysis.
9. Transient stability studies.
10. Economic load dispatch.
11. Load Frequency control of single-area and two-area systems
12. Single-phase semi-converter with R and RL loads
13. Single-phase full-converter with R and RL loads
14. Analysis of Buck and Buck-Boost converter

Note: At least **TEN** experiments should be conducted in the Semester

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VIII

Sl. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration In Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1.	**18EEEXX**	Core Elective-6	3	-	-	3	30	70	3
2.		Open Elective-3	3	-	-	3	30	70	3
PRACTICALS									
3.	**18EEC31**	Technical Seminar	-	-	2	-	50	-	1
4.	**18EEC32**	Project: Part-2	-	-	20	Viva voce	100	100	10
		Total	**6**		**22**		**210**	**240**	**17**

L: Lecture T: Tutorial P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-6
18EEE21	Advanced Electric Drives
18EEE22	Digital Signal Processing
18EEE23	Smart Grid
18EEE24	Digital Control System

Course Code	Open Elective-3
18MEO07	Intellectual Property Rights (IPR)
18CEO02	Disaster Mitigation and Management (DMM)
18ITO02	Python Programming
18EGO02	Gender Sensitization
18PY O01	History of Science and Technology

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18EEE22 **DIGITAL SIGNAL PROCESSING**

(Core Elective – 6)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To explain mathematical representation of signals in continuous, discrete time and frequency domain.
2. To demonstrate analysis of discrete time systems using Z-transforms, Discrete-Fourier Transform (DFT) and the FFT algorithms
3. To illustrate design of IIR and FIR digital filters for various applications.

Course Outcomes: After completion of this course, students will be able to:

1. Represent signals mathematically in continuous and discrete-time domain
2. Analyse discrete-time systems using z-transformation
3. Analyse the Discrete-Fourier Transform (DFT) and FFT algorithms
4. Design analog IIR filter and covert into digital IIR filters by using various digitized techniques
5. Design analog FIR filter by using various windowing techniques

UNIT-I

Discrete-time signals and systems: Sequences, representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals, aliasing, Sampling theorem and Nyquist rate.

UNIT-II

Z-transformations: Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of Z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT-III

Discrete Fourier Transform: Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform (FFT) Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

UNIT-IV

IIR Filters: Design of Butterworth, Chebyshey filters, IIRfilter design by impulse invariant bilinear transformation, impulse invariance method, step invariance method.

UNIT-V

FIR Filters: Characteristics of FIR Digital Filters. Frequency response, comparison of FIR, IIR filters, Window techniques, Design of these filters using Rectangular, Hamming, Bartlet, Kaiser windows, Architecture and features of TMS 320F/2047 and ADSP signal processing chips, Applications of DSP.

Text Books:

1. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.
2. A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.
3. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Prentice Hall, 1997.
4. P. VenkataRamani, M. Bhaskar, "Digital Signal Processo1; Architecture, Programming & Application", TataMcGrawHill-2004

Suggested Reading:

1. Anandkumar A, Digital Signal Processing, Second edition PHI learning, 2015
2. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall,1992.
3. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
4. D. J. DeFatta, J. G. Lucas andW. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons,1988

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With effect from the academic year 2020-21

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC14**	Electrical Machines-II	3	-	-	3	30	70	3
2	**18EEC15**	Power Systems-II	3	-	-	3	30	70	3
3	**18EEC16**	Power Electronics	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective -1	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective -2	3	-	-	3	30	70	3
6	**18MBC01**	Engineering Economics and Accountant	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC17**	Electrical Machines-II Lab	-	-	2	2	15	35	1
8	**18EEC18**	Power Systems-I Lab	-	-	2	2	15	35	1
9	**18EEC19**	Power Electronics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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Course Code	Core Elective-1
18EEE01	Wind and Solar Energy
18EEE02	Optimization Techniques
18EEE03	Electrical Engineering Materials
18EEE04	Electronic Instrumentation

Course Code	Core Elective-2
18EEE05	Simulation Techniques in Electrical Engineering
18EEE06	Energy Conservation & Auditing
18EEE07	Industrial Electrical Systems
18EEE08	Electrical Estimation & Costing

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18EEE07 INDUSTRIAL ELECTRICAL SYSTEMS (Core Elective-2)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand various components of industrial electrical systems and analyze and select the proper size of various electrical system components.
2. Understand the electrical wiring systems for residential and commercial consumers and analyze and select the proper size of various electrical system components.
3. Understand necessity of illumination for specified requirement

Course Outcomes: After completion of this course, students will able to:

1. Understand various components of industrial electrical systems
2. Apply residential and commercial electrical wiring rules and guidelines for installation of electrical systems
3. Design various Illumination schemes and lighting systems
4. Understand HT connection, Industrial loads and LT panel components
5. Select the proper size of various electrical system components

UNIT-I

Electrical System Components: LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, single line diagram (SLD) of a wiring system, Electric shock and Electrical safety practices (Elementary treatment only)

UNIT-II

Residential and Commercial Electrical Systems: Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components. (Elementary treatment only)

UNIT-III

Illumination Systems: Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting. (Elementary treatment only)

UNIT-IV

Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, Earthing design, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components. (Elementary treatment only)

UNIT-V

Industrial Electrical Systems II: DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS & Battery Banks. (Elementary treatment only)

Text Books:

1. S. L. Uppal and G. C. Garg, “Electrical Wiring, Estimating & Costing”, Khanna publishers, 2008.
2. K. B. Raina, “Electrical Design, Estimating & Costing”, New age International, 2007.

Suggested Readings:

1. S. Singh and R. D. Singh, “Electrical estimating and costing”, Dhanpat Rai and Co., 1997.
2. H. Joshi, “Residential Commercial and Industrial Systems”, McGraw Hill Education, 2008.
3. Hemant Joshi "Residential, Commercial and Industrial Electrical Systems: Equipment and selection Volume 1 of Residential, Commercial and Industrial Electrical Systems", Tata McGraw-Hill Education, 2008

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With effect from the academic year 2020-21

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VI

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC20**	Control Systems	3	-	-	3	30	70	3
2	**18EEC21**	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
3	**18EEC22**	Power Systems Operation and Control	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-3	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective-4	3	-	-	3	30	70	3
6	**18XXOYY**	Open Elective-1	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC23**	Control Systems Lab	-	-	2	2	15	35	1
8	**18EEC24**	Microprocessors Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**22**	**210**	**490**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-3
18EEE09	Power Quality
18EEE10	Advanced Power Converters
18EEE11	Electrical Distribution Systems
18EEE12	HVDC Transmission Systems

Course Code	Core Elective-4
18EEE13	AI Techniques In Electrical Engineering
18EEE14	Electric Hybrid Vehicles
18EEE15	FACTS
18EEE16	Special Electrical Machines

Course Code	Open Elective-1
18ECO06	Principles of Embedded Systems (PES)
18CSO07	Basics of Cyber Security (BCS)
18BTO01	Basics of Biology
18PYO01	History of Science and Technology

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18EEE14 **ELECTRIC AND HYBRID VEHICLES (Core Elective -4)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To Know the Electric and Hybrid vehicles, and their advantages and disadvantages
2. To Understand the concept hybrid electric vehicles and energy management
3. To Develop and Optimize the design of propulsion motors for EV applications

Course Outcomes: After the completion of this course, students will be able to:

1. Be familiar to the models of describing hybrid vehicles and their performance.
2. Model the electric vehicles with different acceleration and range
3. Design Electric power train for Electric Vehicles
4. Analyze the different possible ways of energy storage
5. Illustrate the principle of Hybrid Electric Vehicle and Battery Electric Vehicle

UNIT-I

Introduction: Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, Air pollution and global warming, EV System – EV Advantages – Vehicle Mechanics – Performance of EVs, Introduction to Battery Electric Vehicle (BEV), Components and systems of Electric Vehicle, Policies and guidelines for electric mobility, Trends and challenges of implementation of mobility and start up opportunities.

UNIT-II

Hybrid Electric Vehicles: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Electric Vehicle Modelling– Consideration of Rolling Resistance – Transmission Efficiency – Consideration of Vehicle Mass – Tractive Effort – Vehicle Acceleration – Modelling Electric Vehicle Range, Sizing of drive system, Plug-in electric vehicles, Hybrid electric drive for ship propulsion and military application,

UNIT-III

Electric Power Trains: Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybriddrive train topologies, different modes of operation, Power flow control in hybrid drive-train topologies, fuel efficiency analysis, Basic concept of electric traction, Components and systems of HEV, Selection and Sizingof the propulsion motor, Regenerative braking fundamentals, drive system efficiency

UNIT-IV

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage**,** High Energy (Nickel, Sodium and Lithium based) batteries, Metal Air batteries, battery sizing, Fuel Cell based energy storage system, Super Capacitor based energy storage and its analysis, Hybridization of different energy storage devices, Introduction to energy management strategies used in hybrid and electric vehicles.

UNIT-V

Design, Analysis, Testing & Qualification of Propulsion Motor: PM Materials, Basic concepts of Design and analysis of water cooled PM Motor for EV and HEV, Outer rotor PM Motor drive, Basic Design Aspects of Induction for EV and HEV, Testing methods and standards, Different types of EV charging stations, Wireless charging technology, Vehicle to grid (V2G) fundamentals, EMI & EMC mitigation

Text Books:

1. C. Mi, M. A. Masrur, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
3. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.

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Suggested Reading:

1. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003
2. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016
3. Hybrid Vehicles and the future of personal transportation, Allen Fuhs, CRC Press, 2011.
4. Vehicle Power Management: Modeling, Control and Optimization, Xi Zhang, Chris Mi, Springer, 2011.
5. National Electric Mobility Mission Plan 2020 Released by DHI, Govt. of India
6. Zero Emission Vehicles (ZEV) Towards a Policy Framework, NITI Aayog
7. IEC and different IS and Eclectic Mobility Standards.

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Time is what we need most, but what we use worst; Most of the misfortunes in our life are due to misused time.

Vikasa Mantras- Vivekananda Institute of Human Excellence

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-VI

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC23**	Electrical Machinery – III	3/1	-	3	30	70	4
2.	**16EEC24**	Switchgear and Protection	3	-	3	30	70	3
3.	**16EEC25**	Power Semiconductor Drives	3	-	3	30	70	3
4.	**16EEC26**	Microprocessor and Microcontrollers	4	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective- 2	3	-	3	30	70	3
6.	**16EEEXX**	Program Specific Elective - 3	3	-	3	30	70	3
PRACTICALS								
7.	**16EEC27**	Microprocessor and Microcontrollers Lab	0/1	2	3	25	50	2
8.	**16EEC28**	Power Systems Lab	0/1	2	3	25	50	2
9.	**16EEC29**	Mini Project	-	2	-	50	-	1
10.	**16EEC30**	Industrial Visit	Satisfactory / Unsatisfactory					
			22	**06**	**-**	**280**	**520**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-2
16EEE05	High Voltage Engineering (HVE)
16EEE06	Artificial Intelligence Techniques in Electrical Engineering (AITEE)
16EEE07	Switch Mode Power Converters (SMPC)
16EEE08	Optimization Techniques (OT)

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16EEC24

SWITCHGEAR AND PROTECTION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is

1. To know the operation and types of fuses used in power system.
2. To analyze principles of operation of the different types of relays.
3. To comprehend the different principles of protective schemes in power system.
4. To understand the principles of operation of the different types of circuit breakers.
5. To be acquainted with different lightning arrestors and the appropriate circuit for the protection of the various components of power system.
6. To identify the importance of various grounding methods.

Course Outcomes: After completion of the course, the student will be able to

1. Classify various components used in power system protection.
2. Indicate the relay settings of over current and distance relays.
3. Recognize arc quenching mechanisms used in different circuit breakers.
4. Explain the concept of unit and non-unit protection, and how the various associated parameters affect it.
5. Distinguish types and testing of CBs and their applications
6. Review protection of transmission lines, equipment protection and types of lightening arrestors against over voltages.

Unit-I

Protective Relays: Need for protection, Backup protection, Zones of protection, Definitions of relay pickup, dropout and reset values, Classification of relays, Operating principles and construction of electromagnetic and induction relays, Over current, Over voltage and Power relays, Directional features, Universal relay torque equation. Over current protection for radial feeders and ring mains, Protection of parallel lines, Relay settings for over Current relays, Earth fault and phase fault protection.

Unit-II

Static phase and Amplitude Comparators: Characteristics of Dual input comparators, Distance protection, 3-step Distance relays, Characteristics of distance relays on the RX diagram, static over current relay (Block di

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of digital relays. Need of numerical relays, Advantages of numerical relays over solid state relays.

Unit-III

Transformer and Generator Protection: Differential relays, Percentage differential relays, Protection of generator and transformer using percentage differential relays, Split phase, Inter turn protection, Overheating, Loss of excitation, Protection of generators, Buchholz relay, Protection of earthing transformers, Generator transformer unit protection.

Unit-IV

Circuit Breakers: Need for circuit breakers, Arc Properties, Principles of arc quenching theories, Recovery and Restriking voltages, Rated symmetrical, asymmetrical breaking current, Rated making current, Rated capacity, Voltage and Frequency of circuit breakers, Current chopping, Resistance switching, Derivations of RRRV, Types of circuit breakers, Oil, Air, SF6 and Vacuum circuit breakers, Testing of circuit breakers.

Unit-V

Over Voltage Protection: Protection of transmission lines against direct lightening strokes, Ground wires, Protection angle, Protection zones, Height of ground wire, Conductor clearances. Conductor heights, Tower footing resistance and its effects, Equipment protection assuming rod gaps, Arcing horns, Different types of lightening arrestors, construction, Surge absorbers, Peterson coil, Insulation coordination.

Text Books:

1. C.L. Wadhwa, "Electrical Power System", Wiley Eastern Ltd., 2nd Edition, 2013
2. Badriram & Viswakarma, "Power System Protection and Switchgear", Tata McGraw Hill, 2011
3. Sunil S. Rao, " Switchgear and Protection", Khanna Publications, 2008
4. J.B. Gupta, "Switchgear and Protection", S.K. Kataria& Sons, 3rd Edition, 2014.

Suggested Reading:

1. B. Ravindranath, M. Chander , "Power System Protection &Switchgear", New Age International, 2011
2. OZA, "Power System Protection and Switchgear", Tata McGraw Hill, 2010.
3. Y.G. Paithankar, "Power System Protection", PHI, 2nd Edition, 2010.

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AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VII

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC25**	Power System Protection	3	-	-	3	30	70	3
2	**18EEC26**	Electrical Drives	3	-	-	3	30	70	3
3	**18EEC27**	Signals & Systems	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-5	3	-	-	3	30	70	3
5	**18XXOYY**	Open Elective-2	3	-	-	3	30	70	3
PRACTICALS									
6	**18EEC28**	Power Systems-II Lab	-	-	3	3	25	35	1.5
7	**18EEC29**	Electrical Drives Lab	-	-	3	3	25	35	1.5
8	**18EEC30**	Project: Part-1	-	-	4	-	50		2
		Total	**15**	**-**	**10**	**21**	**250**	**420**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-5
18EEE17	Power System Dynamics and Control
18EEE18	Switch Mode Power Converters
18EEE19	Electrical Machine Design
18EEE20	High Voltage Engineering

Course Code	Open Elective-2
18MEO03	Research Methodologies
18MEO04	Entrepreneurship
18EGO01	Technical Writing Skills
18CSO04	Basics of Data Science using R
18CSO07	Basics of Cyber Security

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With effect from the academic year 2021-22

18EEC25 **POWER SYSTEM PROTECTION**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To analyze principles of operation of the different Protection Devices.
2. To understand the different protection schemes employed in the protection of power system
3. To acquire knowledge of Numerical Protection Algorithm

Course Outcomes: After completion of this course, students will be able to

1. Understand basic terminology of relays and types of over current protection of power system.
2. Distinguish the type of distance protection with principle & their application to three phase transmission lines.
3. Choose suitable differential scheme for the protection of various equipment in electrical power system.
4. Describe the principle of operation, and able to calculate the ratings of circuit breakers.
5. Familiarize with different protection methods against over-voltages.
6. Identify various elements of numerical relays, their functions and different techniques used in their design.

UNIT-I

Introduction to Protection Schemes: Need for protection, Backup protection, Zones of protection, Definitions of relay pickup, dropout and reset values, Classification of relays, Operating principles and construction of electromagnetic and induction relays.

Overcurrent Protection: Time-current characteristics, current settings, time settings, overcurrent protection schemes, direction relay, applications of Definite Time, IDMT and Directional relays distribution feeders, Earth fault and phase fault protection schemes, directional earth fault relay, static over current relay, fuse characteristics, types of fuses

UNIT-II

Distance Protection: Introduction, Impedance relay, reactance relay, MHO relay, effect of arc resistance and Power Swings on the performance of Distance Relaying, Selection of distance relays, Three-stepped Distance protection, Comparison of different distance protection schemes, Distance protection of three-phase lines.

UNIT-III

Differential protection: Introduction, simple differential protection, zone of differential protection, Percentage differential relay, Earth-leakage protection, Percentage Differential Protection of Transformers, Differential protection of transformer against Inrush phenomenon, Inter-turn faults in transformer. Differential protection of Bus-bars, Internal and External faults, Protection of Three-phase bus bars. Introduction to the Basic protection of Generator and Induction Motors

UNIT-IV

Circuit Breakers: Arc interruption, restriking voltage, recovery voltage, RRRV, current chopping, resistance switching, classification of circuit breakers, selection of circuit breakers

Over voltage protection: causes for over voltages, protection of transmission lies against direct lightning strokes, ground wires, arcing horns, lightning arrestors, surge absorbers, Peterson coils, insulation coordination

UNIT-V:

Basics of Numerical Protection: Block diagram of numerical relay, Sampling theorem, Least Error Square Technique, Digital Filtering, Numerical Relaying for overcurrent, Differential and distance protection (Elementary Treatment).

Text Books:

1. Badriram& Viswakarma, "Power System Protection and Switchgear", Tata McGraw Hill, 2011
2. Y.G. Paithankar & S.R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.

Suggested Readings:

1. T.S.Madhava Raao, Power System Protection: Static Relays, Tata McGraw-Hill Education 1989
2. P.M.Anderson, Power System Protection, John Wiley, 2012
3. Electricity Training Association, Power System Protection. Vol.2.: Systems and Methods, Institute of engineering and Technology, 1995

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
B.E (EEE)

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
	THEORY								
1	18MT C01	Mathematics - I	3	1	-	3	30	70	4
2	18PY C04	Waves, Optics and Introduction To Quantum Mechanics	3	1	-	3	30	70	4
3	18CS C01	Programming for Problem Solving	3	-	-	3	30	70	3
4	18EG C01	English	2	-	-	2	20	50	2
	PRACTICALS								
5	18PY C07	Waves and Optics Laboratory	-	-	3	3	25	50	1.5
6	18CS C02	Programming and Problem Solving Lab	-	-	4	3	25	50	2
7	18ME C02	Workshop/ Manufacturing Practice	1	-	4	3	25	50	3
8	18EG C02	English Lab	-	-	2	2	15	35	1
		Total	**12**	**02**	**13**	**-**	**200**	**445**	**20.5**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

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18PY C04

WAVES, OPTICS AND INTRODUCTION TO QUANTUM MECHANICS
(for EEE only)

Instruction:	3L+1T Hours per Week
Duration of Semester End Examination:	3 Hours
Semester End Examination:	70 Marks
Continuous Internal Evaluation:	30 Marks
Credits:	4

Course Objectives:
The objectives of the course is to make the student

1. Understands the fundamentals of oscillations.
2. Learns the basic concepts of wave nature of light.
3. Acquires knowledge of lasers and fibre optics.
4. Familiar with Quantum Mechanics.
5. Learns the fundamentals of solids and semiconductors.

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

1. Describe the types of oscillations and analyze them.
2. Demonstrate the wave nature of the light.
3. Describe the types of lasers and optical fibres and their applications.
4. Demonstrate the important concepts of Quantum Mechanics.
5. Identify the electronic materials for engineering applications.

UNIT -I: Waves:
Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator, forced mechanical and electrical oscillators, impedance, steady state motion of forced damped harmonic oscillator.

UNIT-II: Wave Optics:
Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

UNIT-III:
Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity.

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Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, pulse dispersion, application of optical fibres.

UNIT- IV

Introduction to Quantum Mechanics: Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, probability current, Expectation values, Free-particle wave function and wave-packets, Uncertainty principle.

Solution of Wave Equation: Solution of stationary-state Schrodinger equation for one dimensional problems–particle in a box, particle in attractive delta-function potential, square-well potential.

UNIT-V: Introduction to Solids and Semiconductors:

Free electron theory of metals, Fermi level, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands. Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p -n junction.

TEXT BOOKS:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publi., 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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Scheme of Instructions of II Semester of B.E. – Electrical &Electronics Engineering as per AICTE Model Curriculum 2020-21

B.E. –ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER -II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C06	Vector Calculus and Differential Equations	3	1	-	3	40	60	4
2	20EG C01	English	2	-	-	3	40	60	2
3	20PY C06	Electromagnetic Theory and Quantum Mechanics	3	-	-	3	40	60	3
4	20EE C01	Basic Electrical Engineering	3	-	-	3	40	60	3
PRACTICAL									
5	20EG C02	English lab	-	-	2	3	50	50	1
6	20PY C09	Electromagnetic Theory and Quantum Mechanics Lab	-	-	4	3	50	50	2
7	20EE C02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	20ME C01	CAD and Drafting	-	1	3	3	50	50	2.5
9	20MB C02	Community Engagement	30 field + 2P/W			-	50	-	1.5
TOTAL			**11**	**2**	**11**	**-**	**410**	**440**	**20**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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with effect from the Academic Year 2020-21

20PY C06

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS
(Common to ECE & EEE)

Instruction	3L / Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives:

The objectives of the course is to make the student

1. Understand the fundamentals of wave nature of light
2. Familiar with static and dynamic nature of electric and magnetic fields
3. Acquire knowledge of lasers and fiber optics
4. Learn basics of quantum mechanics and properties of solids

Course Outcomes:

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

1. Interpret the wave nature of the light
2. Extend the laws of electric and magnetic fields for wireless communication
3. Explain the principles of lasers and fiber optic communication
4. Find the applications of quantum mechanics
5. Identify semiconductors for engineering applications

UNIT-I

Wave Optics: Huygens' principle – Superposition of waves – Interference of light by wavefront splitting and amplitude splitting –Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction–Concept of N-slits–Diffraction grating. Polarization: Introduction–Malus's law –Double refraction –Nicol's prism–Quarter-wave plate and half-wave plate– Optical activity– Laurent's half shade polarimeter.

UNIT-II

Electrostatics: Calculation of electric field and electrostatic potential for a charge distribution– Divergence and curl of electrostatic field– Laplace's and Poisson's equations for electrostatic potential– Uniqueness theorem.

Magnetostatics: Bio-Savart law–Divergence and curl of static magnetic field –Equation for magnetic vector potential and its solution for given current densities – Feromagnetic, paramagnetic and diamagnetic materials– B-H curve.

Electromagnetic Theory: Review of steady and varying fields – Conduction current and displacement current–Maxwell's equations in differential and integral forms–Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem – Skindepth.

UNIT-III

Lasers: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion – Ruby laser – He-Ne laser – Semiconductor laser –Applications of lasers in engineering and medicine.

Fiber Optics: Introduction –Construction –Principle –Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers –Pulse dispersion –Fiber losses –Fiber optic communication system –Applications.

UNIT-IV

Quantum Mechanics: Introduction –Wave nature of particles – de
significance of ψ –Time-dependent and time-independent Schrodinger e
Probability current –Wave-packets –Uncertainty principle –Particle in infi

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UNIT-V

Physics of Solids and Semiconductors: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level – Bloch's theorem for particles in a periodic potential –Kronig-Penney model – Origin of energy bands –Classification of solids: metals, semiconductors and insulators –Intrinsic and extrinsicsemiconductors–Carriergenerationandrecombination–Carriertransport:diffusionanddrift–P-N junction – Thermistor – Hall effect – LED – Solarcell.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

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Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC15**	Power Systems – II	3/1	-	3	30	70	4
2.	**16EEC16**	Electrical Machinery – II	3/1	-	3	30	70	4
3.	**16EEC17**	Power Electronics	4	-	3	30	70	4
4.	**16EEC18**	Linear Control Systems	3/1	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective-1	3	-	3	30	70	3
PRACTICALS								
6.	**16EEC19**	Electrical Machinery – II Lab	0/1	2	3	25	50	2
7.	**16EEC20**	Power Electronics Lab	0/1	2	3	25	50	2
8.	**16EEC21**	Linear Control Systems Lab	0/1	2	3	25	50	2
			22	**06**	**-**	**225**	**500**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-1
16EE E01	Non Conventional Energy Sources (NCES)
16EE E02	Electrical Engineering Materials (EEM)
16EE E03	Electronic Instrumentation (EI)
16MT E01	Statistical and Numerical Methods (SNM)
	Courses offered to other Departments
16EE E04	Electrical Technology (for BE3/4, ECE, V-SEM) (Elective)
16EEC22	Electrical Machines and Microcontroller Applications Lab (Core) (for BE3/4, Mech & Prod, V-S

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16EEC18

LINEAR CONTROL SYSTEMS

Instruction	3L + 1T Hour per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	4

Course Objectives: The objective of the course is to

1. Understand different types of linear control systems and their mathematical modeling.
2. Gain knowledge of real time applications of closed loop control systems.
3. Study the transfer function of control system components.
4. Study the stability analysis in time domain.
5. Study the stability analysis in frequency domain.
6. Study the concepts of State space representation of Linear Time invariant systems (LTI).

Course Outcomes: After completion of the course, the student will be able to

1. Define different mathematical models for any LTI systems.
2. Outline the transfer function of components used in feedback control systems.
3. Specify design region in the s-plane in terms of settling-time, rise-time and overshoot to step-response.
4. Illustrate the concepts of stability analysis in time domains, which is essential to analyze any system performance.
5. Illustrate the concepts of stability analysis in frequency domains, which is essential to analyze any system performance.
6. Employ the concepts of state space controls.

UNIT-I

Introduction: Open loop, Closed loop System with illustrations and other classification of control systems, Impulse response and Transfer Function, Mathematical modelling of Mechanical and Electrical Systems, Analogous systems, Feedback control characteristics - effects of feedback.

UNIT-II

Transfer Function Representation: Components of control system- Potentiometers, Synchros, DC and AC servo motors, Block diagram representation and its reduction techniques, Signal flow graphs, problems on conversion from block diagram to signal flow graph.

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UNIT-III

Time Response Analysis: Standard test signals, Time response of first and second order systems for unit step input, Time domain specifications , Type of system - Steady state error, static error coefficients,

Stability Analysis-Concept of stability, Routh-Hurwitz criterion, Root locus technique, effect of addition of poles and zeros to open loop transfer function on Root locus, Introduction to PID Controller.

UNIT-IV

Stability Analysis-Frequency Domain: Frequency Domain specifications for a standard second order system, Correlation between time and frequency domain specifications, Stability analysis from Bode plots, Polar plots and Nyquist plots, Introduction to compensators.

UNIT-V

State Space Representation: Concept of State, State Variable, State Models of linear time invariant systems, Derivation for state models from transfer functions and differential equations, Solution of State equation by Laplace method, State Transition matrix and properties, Concept of Observability and Controllability.

Text Books:

1. I.J.Nagrath, M.Gopal, "Control System Engineering", New Age International (P) Limited Publishers, 5th Edition, 2008.
2. B.C. Kuo, "Automatic Control Systems", John wiley and son's Publishers, 9th Edition, 2009
3. K.Ogata, "Modern Control Systems", 5th Edition.PHI publication, 2010.

Suggested Reading:

1. M.Gopal, "Control Systems Principles and Design",- Tata McGraw Hill, 2nd Edition, 2003.
2. N.C Jagan, "Control Systems", BS Publications, 2nd Edition, 2008
3. N. Nise, "Control Systems Engineering",6th Edition, Willey Publications, 2011.

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16EEC21

LINEAR CONTROL SYSTEMS LAB

Instruction	1T + 2 Periods per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Understand the characteristics of DC Servo Motor.
2. Understand the characteristics of AC Servo Motor.
3. Understand Synchro pair operation.
4. Understand the time domain specifications in time domain.
5. Understand the frequency response of compensating networks.
6. Study the closed loop performance for given plant using
   i) P, PI and PID controllers ii) ON/OFF controller.

Course Outcomes: After completion of the course, the student will be able to

1. Define DC, AC Servo Motors Characteristics.
2. Describe and analyze Synchro pair Characteristics.
3. Design and Analyze the performance of a given second order plant in time domain.
4. Design and Analyze the performance of a given second order plant in frequency domain.
5. Select and state the design function of position and level control systems.
6. Acquire knowledge in analyzing the performance of P, PI, PID and ON/OFF controller.

List of Experiments

1. Characteristics of D.C. Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Step response of second order system.
5. Frequency response of compensating networks.
6. Closed loop P, PI and PID Controller for temperature of a given plant.
7. Step response and Frequency response of a given plant.
8. Level Control System.
9. Temperature control system-ON/OFF Control.
10. Characteristics of magnetic amplifier.
11. Linear System simulator.
12. DC Position Control System.
13. AC Position Control System.

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Note: **At least TEN experiments should be conducted in the Semester.**

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AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VI

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC20**	Control Systems	3	-	-	3	30	70	3
2	**18EEC21**	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
3	**18EEC22**	Power Systems Operation and Control	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-3	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective-4	3	-	-	3	30	70	3
6	**18XXOYY**	Open Elective-1	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC23**	Control Systems Lab	-	-	2	2	15	35	1
8	**18EEC24**	Microprocessors Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**22**	**210**	**490**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-3
18EEE09	Power Quality
18EEE10	Advanced Power Converters
18EEE11	Electrical Distribution Systems
18EEE12	HVDC Transmission Systems

Course Code	Core Elective-4
18EEE13	AI Techniques In Electrical Engineering
18EEE14	Electric Hybrid Vehicles
18EEE15	FACTS
18EEE16	Special Electrical Machines

Course Code	Open Elective-1
18ECO06	Principles of Embedded Systems (PES)
18CSO07	Basics of Cyber Security (BCS)
18BTO01	Basics of Biology
18PYO01	History of Science and Technology

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18EEC20 **CONTROL SYSTEMS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand different types of linear control systems and their mathematical modeling.
2. To study the stability analysis both in time and frequency domains.
3. To study the concepts of State space representation of Linear Time invariant systems (LTI).

Course Outcomes: After the completion of this course, students will be able to:

1. Understand different mathematical models for any electromechanical LTI systems.
2. Analyze the given first and second order systems based on their performance parameters.
3. Analyze absolute and relative stability of an LTI system using time and frequency domain techniques.
4. Analyze the effects of controller on a given system and to understand the concepts of compensators.
5. Develop various state space models for LTI systems and to check the concepts of Controllability and Observability.

UNIT-I

Introduction to control Systems: Open loop, closed loop System with illustrations and other classification of control systems, Impulse response and Transfer Function, Mathematical modeling of Mechanical and Electrical Systems, Analogous systems, Feedback control characteristics - effects of feedback, D.C & A.C servo motors, Synchro pair as an error detector, Block diagram algebra, Signal flow graphs and problems on conversion from block diagram to signal flow graph.

UNIT-II

Time Response Analysis: Standard test signals, Time response of first and second order systems for standard test inputs, Application of initial and final value theorem, Static error coefficients and steady state error (for standard test input signals) Design specifications for second-order systems based on the time-response.
Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique, Construction of Root-loci.

UNIT-III

Frequency-response analysis: Design specifications in frequency-domain, Relationship between time and frequency response, bode plots, Polar plots, Nyquist stability criterion, Relative stability using Nyquist criterion . Stability analysis of plots based on gain and phase margin.

UNIT-IV

Introduction to Controllers and Compensators:
Introduction to Proportional, Integral and Derivative, Proportional plus derivative, Proportional plus integral, Proportional plus integral plus derivative controllers, Introduction to Lead, Lag, Lead-lag and Lag-lead compensators.

UNIT-V

State variable Analysis and Nonlinear systems: Concepts of state variables, State space model, Diagonalization of State Matrix, State transition matrix and its properties, Solution of state equations, Eigenvalues and Stability Analysis, Concept of controllability and observability. Introduction to non-linear systems with suitable examples.

Text Books:

1. I.J. Nagrath, M. Gopal, Control System Engineering, New Age International (P) Limited Publishers, 5th Edition, 2008.
2. B.C. Kuo, Automatic Control Systems, John Wiley and son's Publishers, 9th edition, 2009
3. K. Ogata, Modern Control Systems, 5th Edition.PHI publication, 2010.
4. A. Anand Kumar, Control Systems, 2nd Edition, PHI publications, 2014.

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18EEC23 **CONTROL SYSTEMS LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To understand the characteristics of DC, AC Servo Motors, synchro pair and the frequency response of compensating networks.
2. To study the closed loop performance for given plant using i) P, PI and PID controllers, ii) ON/OFF controller.
3. To perform Simulation studies on for linear time invariant systems

Course Outcomes: After the completion of this course, students will be able to:

1. Demonstrate the characteristics of DC, AC Servo motors and Synchro pair.
2. Analyze the performance parameters for a given second order plant both in time and frequency domain.
3. Analyze the performance of different compensators through frequency response .
4. Design P, PI, PID and ON/OFF controller for a given system and to distinguish the merits and demerits of these controllers.
5. Apply different stability techniques for linear time invariant systems using simulation and then verify with the theoretical calculations

LIST OF EXPERIMENTS

Part A

1. Characteristics of D.C Servo motor.
2. Characteristics of A.C. Servo motor.
3. Characteristics of Synchro Pair.
4. Performance parameters of a second order system excited with step input for different damping ratios.
5. Frequency response of lag and lead compensating networks.
6. Performance of a temperature control system using P, PI and PID Controllers.
7. Temperature control of a system using relay (ON/OFF Control).
8. a) Characteristics of magnetic amplifier for series and parallel connections with different values of resistive load.
   b) Measurement of Step angle for Stepper motor.
9. Find the response of different components of a control system using Linear System Simulator.
10. Demonstration of damping effect on the plant using DC Position Control system.

Part B

1. Stability Analysis (Root locus, Bode and Nyquist) for Linear Time Invariant systems.
2. a) Time Domain specifications for a second order system.
   b) Frequency Domain specifications for a second order system.
3. State space model for a given classical transfer function and its verification.
4. Design and analyze different compensators (lag, lead and lag-lead).

Note: At least **EIGHT** Experiments from **Part A** and **TWO** from **Part B** should be conducted in the semester.

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Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC15**	Power Systems – II	3/1	-	3	30	70	4
2.	**16EEC16**	Electrical Machinery – II	3/1	-	3	30	70	4
3.	**16EEC17**	Power Electronics	4	-	3	30	70	4
4.	**16EEC18**	Linear Control Systems	3/1	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective-1	3	-	3	30	70	3
PRACTICALS								
6.	**16EEC19**	Electrical Machinery – II Lab	0/1	2	3	25	50	2
7.	**16EEC20**	Power Electronics Lab	0/1	2	3	25	50	2
8.	**16EEC21**	Linear Control Systems Lab	0/1	2	3	25	50	2
			22	**06**	**-**	**225**	**500**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-1
16EE E01	Non Conventional Energy Sources (NCES)
16EE E02	Electrical Engineering Materials (EEM)
16EE E03	Electronic Instrumentation (EI)
16MT E01	Statistical and Numerical Methods (SNM)
	Courses offered to other Departments
16EE E04	Electrical Technology (for BE3/4, ECE, V-SEM) (Elective)
16EEC22	Electrical Machines and Microcontroller Applications Lab (Core) (for BE3/4, Mech & Prod, V-SEM)

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16EEE01

NON-CONVENTIONAL ENERGY SOURCES

Instruction	3Hours per week
Duration of Semester Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the fundaments of energy and significance of conventional and non conventional energy sources.
2. To comprehend the list of various Energy Sources
3. To know the design of solar PV system
4. To become familiar in implementing solar thermal systems.
5. To become aware about wind energy conversion systems.
6. To understand the need of Energy Conservation and its related features.

Course Outcomes: The student will be able to

1. Acquire the knowledge of various Non conventional energy sources and its relative merits and demerits.
2. Identify the need of energy conservation and storage methods.
3. Experiment with solar photo voltaic systems to validate theoretical analysis.
4. Compare the various MPPT techniques.
5. Assess the solar thermal application for a given requirement
6. Justify the suitability of wind Energy Conversion Systems for a given site conditions.

UNIT-I

Fundamentals of Energy: Introduction, Classification of energy resources, importance of Non Conventional Energy Sources, Common forms of energy, Advantages and Disadvantages of conventional energy sources, Merits and Demerits of non conventional energy sources, various aspects of energy conservation, co- generation, Energy storage methods (Elementary treatment only)

UNIT-II

Introduction to Energy Sources: Solar Energy, Wind energy, Biomass energy, Geothermal energy, Ocean energy, Fuel Cell, MHD, Small Hydro resources.

UNIT-III

Solar Photo Voltaic Systems: Solar cell fundamentals, Solar Cell characteristics, solar cell classification, solar cell, Module, Panel and Array Construction, Maximizing the solar PV output and load matching, MPPT, Solar PV Systems, solar PV applications.

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UNIT-IV

Solar Thermal Systems: Solar collectors, Solar water heater, solar cooker, Solar furnace, Solar dryer, Solar distillation.

UNIT-V

Wind Energy Systems: Origin of winds, wind turbine sitting, major applications of wind power, wind turbine aerodynamics, Wind energy conversion systems (WECS), Wind Energy Storage.

Text Books:

1. B.H. Khan, "Non Conventional Energy Resources" McGraw-Hill Education, 2015.
2. Chetan Singh Solanki, "Renewable Energy Technology - A practical guide for beginners", PHI, 2009.

Suggested Reading:

1. D.P.Kothari, KC Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI, 2014.
2. Mukharjee D., "Renewable Energy Systems", New Age International 2004.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC14**	Electrical Machines-II	3	-	-	3	30	70	3
2	**18EEC15**	Power Systems-II	3	-	-	3	30	70	3
3	**18EEC16**	Power Electronics	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective -1	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective -2	3	-	-	3	30	70	3
6	**18MBC01**	Engineering Economics and Accountant	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC17**	Electrical Machines-II Lab	-	-	2	2	15	35	1
8	**18EEC18**	Power Systems-I Lab	-	-	2	2	15	35	1
9	**18EEC19**	Power Electronics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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Course Code	Core Elective-1
18EEE01	Wind and Solar Energy
18EEE02	Optimization Techniques
18EEE03	Electrical Engineering Materials
18EEE04	Electronic Instrumentation

Course Code	Core Elective-2
18EEE05	Simulation Techniques in Electrical Engineering
18EEE06	Energy Conservation & Auditing
18EEE07	Industrial Electrical Systems
18EEE08	Electrical Estimation & Costing

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18EEE01 **WIND AND SOLAR ENERGY SYSTEMS (Core Elective - 1)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To familiarize Non-Conventional energy sources for sustainable energy conversion.
2. To understand working of wind power generation and wind energy conversion systems.
3. To understand the working of solar energy systems and Explore the issues with integration of renewable energy sources.

Course Outcomes: After the completion of this course, students will be able to:

1. Understanding the significance of non-conventional energy sources
2. Apply the knowledge of physical requirement of wind power energy systems
3. Analyze the required parameters for generator, turbine and converter suitable for a specific wind-generation topology.
4. Understand solar thermal systems
5. Analyze the network integration issues

UNIT-I:

Fundamentals of Energy: Introduction, Classification of energy resources, importance of Non Conventional Energy Sources, Common forms of energy, Merits and Demerits of non-conventional energy sources over conventional energy sources.

UNIT-II

Physics of Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions. Review of modern wind turbine technologies, Fixed and Variable speed wind turbines.

UNIT-III

Wind generator topologies: Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters, Generator-Converter configurations, Converter Control, Wind farm behavior during grid disturbances, Power quality issues, Power system interconnection experiences in the world, Hybrid and isolated operations of wind systems.

UNIT-IV

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability. Peak Sun Hours (PSH) at a location

Solar photovoltaic: Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Maximum Power Point Tracking (MPPT) algorithms, Balance of System Components, Solar PV Systems, Solar PV Applications

Solar Thermal Systems: Introduction, Solar Collectors, Solar Water Heater, Solar Passive Space Heating and Cooling Systems, Solar Industrial Heating Systems, Solar Refrigeration and Air Conditioning Systems, Solar Cookers

UNIT-V

Network Integration Issues: Overview of grid code technical requirements, Fault ride-through for wind farms -real and reactive power regulation, voltage and frequency operating limits.

Text Books:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005
2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.

Suggested Reading:

1. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd., 2006
2. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004
3. J. A. Duffie & W.A. Beckman, "Solar Engineering of Thermal Processes", John

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-VI

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC23**	Electrical Machinery – III	3/1	-	3	30	70	4
2.	**16EEC24**	Switchgear and Protection	3	-	3	30	70	3
3.	**16EEC25**	Power Semiconductor Drives	3	-	3	30	70	3
4.	**16EEC26**	Microprocessor and Microcontrollers	4	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective- 2	3	-	3	30	70	3
6.	**16EEEXX**	Program Specific Elective - 3	3	-	3	30	70	3
PRACTICALS								
7.	**16EEC27**	Microprocessor and Microcontrollers Lab	0/1	2	3	25	50	2
8.	**16EEC28**	Power Systems Lab	0/1	2	3	25	50	2
9.	**16EEC29**	Mini Project	-	2	-	50	-	1
10.	**16EEC30**	Industrial Visit	Satisfactory / Unsatisfactory					
			22	**06**	**-**	**280**	**520**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-2
16EEE05	High Voltage Engineering (HVE)
16EEE06	Artificial Intelligence Techniques in Electrical Engineering (AITEE)
16EEE07	Switch Mode Power Converters (SMPC)
16EEE08	Optimization Techniques (OT)

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16EE E06

AI TECHNIQUES IN ELECTRICAL ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
University Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: The objective of the course is to

1. Practice the concepts soft computing techniques and comprehensive knowledge of fuzzy logic control and to design the fuzzy control.
2. Expose students to the basic ideas, challenges, techniques and problems in artificial intelligence.
3. Know different types of neural networks and training algorithms
4. Know the applications of AI Techniques in electrical engineering applications
5. Analyse the metaheuristic techniques in real-world problems.
6. Introduce to the basic concepts of Artificial Intelligence with illustrations of current state of the art research and applications.

Course Outcomes: After the completion of the course the student will be able to

1. Understand concepts of ANNs, Fuzzy logic and metaheuristic Techniques.
2. Remember difference between knowledge based systems and algorithmic based systems.
3. Understand operation of Fuzzy controller and metaheuristic algorithms
4. Apply soft computing techniques for real-world problems
5. Analyse critically the techniques presented and apply them to electrical Engineering problems.
6. Apply metaheuristic techniques to Electrical problems.

UNIT-I

Artificial Neural Networks: Introduction, Models of Neural Network, Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, Competitive learning, Boltzman learning, Supervised learning, Unsupervised learning, Reinforcement learning, learning tasks.

UNIT- II

Fuzzy Logic: Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy cartesion Product, Operations on Fuzzy relations, Fuzzy logic, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, Defuzzification methods.

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UNIT- III

Metaheuristic Techniques-1: Introduction, Particle Swarm Optimization- swarm intelligence, PSO algorithms,Accelerated PSO, Implementation- Multimodal Functions, Validation, Simulated Annealing-Annealing and Probability, Choice of Parameters, SA Algorithm, Implementation, Ant Algorithms- Behaviour of Ants, Ant Colony Optimization, Double Bridge Problem, Virtual Ant Algorithm.

UNIT-IV

Metaheuristic Techniques-2: Bee Algorithms- Behavior of Honey Bees, Bee Algorithms- Honey Bee Algorithm, Virtual Bee Algorithm, Artificial Bee Colony Optimization, Applications, Harmony Search algorithm, Music-Based Algorithms, Harmony Search, Implementation.

UNIT-V

Applications of AI Techniques: Economic load dispatch, Load frequency control, Single area system and two area system, Reactive power control, speed control of DC and AC Motors.

Text Books:

1. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms",PHI, New Delhi, 2010.
2. Xin-SheYang, "Engineering Optimization: An Introduction with Metaheuristic Applications",Wiley publication, 2010.

Suggested Reading:

1. P.D.Wasserman,VanNostrandReinhold, "Neural Computing Theory & Practice", New York,1989.
2. Bart Kosko, "Neural Network & Fuzzy System" Prentice Hall, 1992.

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With effect from the academic year 2020-21

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VI

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC20**	Control Systems	3	-	-	3	30	70	3
2	**18EEC21**	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
3	**18EEC22**	Power Systems Operation and Control	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-3	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective-4	3	-	-	3	30	70	3
6	**18XXOYY**	Open Elective-1	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC23**	Control Systems Lab	-	-	2	2	15	35	1
8	**18EEC24**	Microprocessors Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**22**	**210**	**490**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-3
18EEE09	Power Quality
18EEE10	Advanced Power Converters
18EEE11	Electrical Distribution Systems
18EEE12	HVDC Transmission Systems

Course Code	Core Elective-4
18EEE13	AI Techniques In Electrical Engineering
18EEE14	Electric Hybrid Vehicles
18EEE15	FACTS
18EEE16	Special Electrical Machines

Course Code	Open Elective-1
18ECO06	Principles of Embedded Systems (PES)
18CSO07	Basics of Cyber Security (BCS)
18BTO01	Basics of Biology
18PYO01	History of Science and Technology

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With effect from the academic year 2020-21

18EEE13 AI TECHNIQUES IN ELECTRICAL ENGINEERING (Core Elective -4)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To locate soft computing methodologies, such as artificial neural networks and Fuzzy logic algorithms
2. To expose students to the basic ideas, challenges, techniques and learning algorithms in ANN and fuzzy logic techniques
3. To know the applications of AI Techniques in electrical engineering and to analyse the metaheuristic techniques in real-world problems.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand the concepts of ANNs, Fuzzy logic and metaheuristic Techniques
2. Identify and describe Artificial Neural Network and Fuzzy Logic techniques in building intelligent machines
3. Apply Artificial Neural Network & Fuzzy Logic models to handle uncertainty and solve engineering problems
4. Understand how metaheuristics can be used to find good enough solutions for computationally hard optimization problems
5. Apply metaheuristic techniques to the optimization problems related to electrical Engineering
6. Develop fuzzy logic control and metaheuristic technique for applications in electrical engineering

UNIT – I

Artificial Neural Networks: Introduction, Models of Neural Network, Architectures, Knowledge representation, Artificial Intelligence and Neural networks, Learning process, Error correction learning, Hebbian learning, learning tasks.

UNIT II

ANN Paradigms: Multilayer perception using Back Propagation Algorithm, Self organizing Map, Radial Basis Function Network, Functional link network, Hopfield Network, speed control of DC and AC motors using Neural Network.

UNIT- III

Fuzzy Logic: Introduction, Fuzzy versus crisp, Fuzzy sets, Membership function, Basic Fuzzy set operations, Properties of Fuzzy sets, Fuzzy Cartesian Product, Operations on Fuzzy relations, Fuzzy Quantifiers, Fuzzy Inference, Fuzzy Rule based system, De-fuzzification methods, Speed control of DC and AC motors using Fuzzy logic controller.

UNIT-IV

Metaheuristic Techniques-1: Introduction, Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO), Harmony Search (HS) algorithms, Implementation of algorithms with test functions for optimization, Economic load dispatch using PSO, ACO, HS algorithms

UNIT- V

Metaheuristic Techniques-2: Teaching Learning Based Optimization Algorithm, differential evolution algorithm, Artificial bee colony algorithm, Implementation of algorithms with test functions for optimization, Single area system and two area system, Reactive power control

Text Books:

1. S. Rajasekaran and G.A.V. Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms”- PHI, New Delhi, 2010.
2. Xin-She Yang, “Engineering Optimization: An Introduction with Metaheuristic Applications”- Wiley publication, 2010.

Suggested Reading:

1. P.D. Wasserman, VanNostrandReinhold,” Neural Computing Theory & Practice”- New York,1989.
2. Bart Kosko,” Neural Network & Fuzzy System” Prentice Hall, 1992.
3. Yagna Narayana, " Artificial Nueral Networks" -PHI, New Delhi,2012

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AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VI

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC20**	Control Systems	3	-	-	3	30	70	3
2	**18EEC21**	Microprocessors and Microcontrollers	3	-	-	3	30	70	3
3	**18EEC22**	Power Systems Operation and Control	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-3	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective-4	3	-	-	3	30	70	3
6	**18XXOYY**	Open Elective-1	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC23**	Control Systems Lab	-	-	2	2	15	35	1
8	**18EEC24**	Microprocessors Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**22**	**210**	**490**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-3
18EEE09	Power Quality
18EEE10	Advanced Power Converters
18EEE11	Electrical Distribution Systems
18EEE12	HVDC Transmission Systems

Course Code	Core Elective-4
18EEE13	AI Techniques In Electrical Engineering
18EEE14	Electric Hybrid Vehicles
18EEE15	FACTS
18EEE16	Special Electrical Machines

Course Code	Open Elective-1
18ECO06	Principles of Embedded Systems (PES)
18CSO07	Basics of Cyber Security (BCS)
18BTO01	Basics of Biology
18PYO01	History of Science and Technology

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18EEC24 **MICROCONTROLLERS AND ITS APPLICATIONS LAB**

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
Semester End Examination	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To explain instruction set of 8051 microcontroller
2. To demonstrate assembly language programming using 8051 microcontroller
3. To illustrate programming 8051 microcontroller with 'embedded C' Language.

Course Outcomes: After completion of the course, students will be able to:

1. Use instruction set of 8051 microcontroller to develop ALPs.
2. To write and execute simple programs using 8051 microcontroller.
3. Demonstrate the functioning of different instructions and subroutines using 8051 programming.
4. Create small application models by interfacing devices to 8051 programming through Keil/ Ride software.
5. Apply the knowledge of experiments done in the laboratory for doing mini projects and academic projects.

List of Experiments

PART-A

Using 8051 Microcontroller Kit:

1. Programs using Data Transfer Instructions- Block move, Exchange, Sorting, Finding Largest Element in an Array.
2. Programs using Arithmetic Instructions: Multi byte operations
3. Programs using Boolean and Logical Instruction (Bit manipulations).
4. Programs using JUMP and CALL Instructions
5. Programs to generate delay, programs using serial port and on chip timer/counter.
6. Programs using Look-up Table
7. Programs using interrupts.

PART-B

Program Development using 'c' cross compiler for 8051 Microcontroller

(Any 3 of the below mentioned experiments are to be Conducted)

1. DAC interfacing for Generation of Sinusoidal Waveform.
2. Stepper Motor control (clockwise and anticlockwise directions)
3. Interfacing of Keyboard and 7-segment Display Module
4. ADC interfacing for temperature monitoring
5. Traffic signal light controller

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-VI

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC23**	Electrical Machinery – III	3/1	-	3	30	70	4
2.	**16EEC24**	Switchgear and Protection	3	-	3	30	70	3
3.	**16EEC25**	Power Semiconductor Drives	3	-	3	30	70	3
4.	**16EEC26**	Microprocessor and Microcontrollers	4	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective- 2	3	-	3	30	70	3
6.	**16EEEXX**	Program Specific Elective - 3	3	-	3	30	70	3
PRACTICALS								
7.	**16EEC27**	Microprocessor and Microcontrollers Lab	0/1	2	3	25	50	2
8.	**16EEC28**	Power Systems Lab	0/1	2	3	25	50	2
9.	**16EEC29**	Mini Project	-	2	-	50	-	1
10.	**16EEC30**	Industrial Visit	Satisfactory / Unsatisfactory					
			22	**06**	**-**	**280**	**520**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-2
16EEE05	High Voltage Engineering (HVE)
16EEE06	Artificial Intelligence Techniques in Electrical Engineering (AITEE)
16EEE07	Switch Mode Power Converters (SMPC)
16EEE08	Optimization Techniques (OT)

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16EEC27

MICROPROCESSORS & MICROCONTROLLERS LAB

Instruction	1T + 2P Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: The objective of the course is to

1. Write and execute simple programs using MASM software tool.
2. Get the students acquainted with the processor kit and improve their Programming skills.
3. Make the students work with controller and understand how to program and get the desired output in different platforms.
4. Describe various instruction set of 8086 microprocessor used in programming.
5. Illustrate the need of interfacing experiments.
6. Aanalyze the processer and controller kits.

Course Outcomes: After completion of the course, the student will be able to

1. Use instruction set of 8086 Microprocessor to develop ALP's.
2. Write ALP programs of 8086 microprocessor that suits for MASM software.
3. Demonstrate the functioning of interfacing devices using 8086 programming.
4. Use instruction set of 8051 microcontroller to develop ALP's
5. Demonstrate the functioning of interfacing devices using 8051 programming through Keil software.
6. Relate the experiments done in laboratory for doing mini projects and academic project.

List of Experiments

For 8086Microprocessor:

Section 1: Using MASM/TASM (<u>Any 3</u> of the below mentioned Expts. are to be conducted in this Section).

1. Programs for signed/unsigned multiplication and division.
2. Programs for finding average of N 16-bit numbers.
3. Programs for finding the largest number in an array.
4. Programs for code conversion like BCD numbers to 7-Segment.
5. Programs for computing factorial of a positive integ

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Section 2: Using 8086 Kit(Interfacing) (**Any 2 of** the below mentioned Expts. are to be conducted in this Section).

1. 8255-PPI: Write ALP's to generate triangular, saw-tooth and square waveforms using DAC.
2. 8279-Keyboard Display: Write a small program to display a string of characters.
3. Write an ALP to display some alpha-numeric characters on a seven-segment display module.
4. Traffic Signal Controller.

For 8051 Microcontroller:

Section 3: Using 8051 Kit (**Any 3 of** the below mentioned Expts. are to be conducted in this section).

1. Data Transfer - Block move, Exchange, sorting, Finding largest element in an array.
2. Arithmetic Instructions :Multi byte operations
3. Boolean & Logical Instructions (Bit manipulations).
4. Use of JUMP and CALL instructions.
5. Programs to generate delay and programs using serial port and on chip timer/counter.

Section 4: Program Development using 'c' cross compiler for 8051 (**Any 2 of** the below mentioned Expts. are to be conducted in this section).

1. DAC interfacing for Generation of Sinusoidal Waveform.
2. Stepper motor control(clockwise and anticlockwise directions).
3. Interfacing of Keyboard and 7-segment Display Module.
4. ADC interfacing for temperature monitoring.

Major Equipment required for the LAB:

1. 8086 Microprocessor trainer kit(s) with in-built assembler/disassembler.
2. 8051 Microcontroller trainer kit(s).
3. Interfacing Modules for both 8086 and 8051.
4. MASM Software and Kiel/Ride Cross-'c' compiler Software.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC14**	Electrical Machines-II	3	-	-	3	30	70	3
2	**18EEC15**	Power Systems-II	3	-	-	3	30	70	3
3	**18EEC16**	Power Electronics	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective -1	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective -2	3	-	-	3	30	70	3
6	**18MBC01**	Engineering Economics and Accountant	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC17**	Electrical Machines-II Lab	-	-	2	2	15	35	1
8	**18EEC18**	Power Systems-I Lab	-	-	2	2	15	35	1
9	**18EEC19**	Power Electronics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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Course Code	Core Elective-1
18EEE01	Wind and Solar Energy
18EEE02	Optimization Techniques
18EEE03	Electrical Engineering Materials
18EEE04	Electronic Instrumentation

Course Code	Core Elective-2
18EEE05	Simulation Techniques in Electrical Engineering
18EEE06	Energy Conservation & Auditing
18EEE07	Industrial Electrical Systems
18EEE08	Electrical Estimation & Costing

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With effect from the academic year 2020-21

18EEE06 ENERGY CONSERVATION AND AUDITING (Core Elective-2)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To know the concept of energy conservation and auditing
2. To understand the formulation of efficiency for various electrical systems
3. To explore the different ways to design various technologies for efficient electrical systems.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand about current energy scenario and importance of energy conservation
2. Apply the concepts of energy management
3. Analyze the performance of existing electrical and industrial systems
4. Understand different energy efficient systems in electrical and industrial systems
5. Apply the energy efficiency techniques in electrical systems

UNIT-I:

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future.

UNIT-II:

Basics of Energy and its various forms: Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-III

Energy Efficiency in Electrical Systems: Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

UNIT-IV

Energy Efficiency in Industrial Systems: Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers (elementary treatment)

UNIT-V

Energy Efficient Technologies in Electrical Systems: controllers, energy efficient motors, soft starters with Maximum demand controllers, automatic power factor energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

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Text Books:

1. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online)
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online)

Suggested Reading:

1. S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991
2. Y. P. Abbi, Energy Audit: Thermal Power, Combined Cycle, and Cogeneration Plants, The Energy and Resources Institute, 2012, ISBN 978-81-7993-311-4
3. Tarik Al-Shemmeri, "Energy Audits: A Workbook for Energy Management in Buildings", August 2011.
4. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

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If we have built castles in the air, our work need not be lost; that is where they should be. Now lay the foundation under them. But a fool is one who, having no goal, redoubles his efforts.

Vikasa Mantras- Vivekananda Institute of Human Excellence

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.E. – Electrical & Electronics Engineering as per AICTE Model Curriculum 2020-21

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20MT C05	Calculus	3	1	-	3	40	60	4
2	20CYC01	Chemistry	3	-	-	3	40	60	3
3	20CE C01	Engineering Mechanics-I	3	-	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	3	-	-	3	40	60	3
PRACTICAL									
5	20CY C02	Chemistry Lab	-	-	4	3	50	50	2
6	20CS C02	Programming for Problem Solving Lab	-	-	4	3	50	50	2
7	20ME C02	Workshop/ Manufacturing Practice	-	-	5	3	50	50	2.5
8	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
TOTAL			**12**	**1**	**13**	**-**	**360**	**390**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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with effect from the Academic Year 2020-21

20ME C03

ENGINEERING EXPLORATION (PRACTICAL)

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition, Willey.
2. Matthew Python, "Arduino programming for beginners", Independently published, 2020.
3. Patrick F. Dunn , "Measurement and data Analysis for engineering and science" , third edition, 2014.
4. Andrew Stellman, Jennifer Greene, "Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices", Kindle Edition.

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Suggested Reading:

1. Charles B. Fleddermann, “Engineering ethics”, fourth edition, Prentice Hall, 2012.
2. Rob Lawlor, “Engineering in society”, second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, “Engineering for sustainable development: Guiding principles”, The Royal Academy of engineering, 2005.
4. Richard S. Paul, “Robot Manipulators: Mathematics, Programming, and Control”, MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME				
S. No	**Name of the module**	**Work Hours**	**Marks**	**Evaluation**
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
SCHEME OF INSTRUCTION AND EXAMINATION
VII-Semester of B.E/B.Tech under CBCS
B.E.(EEE)

SEMESTER-VII

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EE C31**	Power System Operation and Control	4	-	3	30	70	4
2.	**16EE C32**	Utilization of Electrical Energy	3	-	3	30	70	3
3.	**16EE C33**	DSP and Embedded Systems	4	-	3	30	70	4
4.	**16EE EXX**	Program Specific Elective- 4	3	-	3	30	70	3
5.	**16XX OYY**	Open Elective-I	3	-	3	30	70	3
PRACTICALS								
6.	**16EE C34**	Power Systems Simulation Lab	0/1	2	3	25	50	2
7.	**16EE C35**	Digital Signal Processor and Embedded Systems Lab`	0/1	2	3	25	50	2
8.	**16EE C36**	Project Seminar	0	3	-	50	-	2
			19	**07**	**-**	**250**	**450**	**23**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-4
16EEE14	Basic VLSI Design
16EEE15	Computer Methods in Power Systems(CMPS)
16EEE16	Power Quality Engineering(PQE)
16EEE17	Special Electrical Machines(SEM)

Course Code	Open Elective-I
16PY O01	History of Science and Technology
16EG O02	Gender Sensitization
16CE O02	Disaster Mitigation and Management (DMM)
16CS O10	Machine Learning Using Phyton
16ME O01	Entrepreneurship

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16EE C31

POWER SYSTEM OPERATION AND CONTROL

Instruction	4 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. To understand the formulation of Load-Flow problems applying different methods and economic operation of power systems
2. To understand the importance of Load Frequency Control and stability of power systems.
3. To study the reactive power control and basic FACTS controllers

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge in assessing the importance of load flow studies in power system operation. Carryout Load-Flow studies with different methods compare and interpret the results.
2. Acquire knowledge in conducting Economic operation of power system without and with losses
3. Acquire knowledge in conducting Load Frequency Control for single and two area systems and also distinguish between different control methods.
4. Acquire knowledge in analyzing the Stability aspects of power system.
5. Acquire knowledge in assessing the system improvement through reactive power control and FACTS controllers.

UNIT-I

Load Flow Studies: Formulation of Y bus for a system, modeling of tap changing and phase shifting transformer, Formulation of load flow problem, Solution of load flow by Gauss Seidel, Newton- Raphson, Decoupled and Fast Decoupled methods, comparison of different load flow methods.

UNIT-II

Economic Operation of Power System: Input-Output curves, Heat rates and incremental cost curves, Equal Incremental cost criterion Neglecting transmission losses with and without generator limits, B_{mn} Coefficients, Economic operation including transmission losses.

architecture, Address generation unit, speed issues, fixed point DSPs - Architecture of TMS 320C 54X Processor , addressing modes, on-chip peripherals, Real Time operating constraints

UNIT-IV

Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores, Shared Data, Message Queues, Mailboxes and Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment. Semaphores and Queues, Hard Real-TimeScheduling Considerations, Host and Target machines, Linker/Locators for Embedded Software.

UNIT-V

Advanced architectures: ARM Processor, memory organization and Instruction level parallelism, Net advanced embedded systems: Bus protocols, 12C bus and CAN bus, Internet- Enabled Systems

Text Books:

1. Avatar Singh and S. Srinivasan, " Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.
2. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Morgan Kaufmann Publisher, 2006.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007.
3. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.

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16EE C34

POWER SYSTMES SIMULATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To understand the load flows, transient stability studies, economic load dispatch and load frequency control in power system
2. To understand the time and frequency response of the system
3. To Simulate and compare the output of converters with different loads

Course Outcomes: After completion of this course, students will be able to:

1. Acquire knowledge about Load frequency control
2. Analyse Load flow studies and economic load dispatch
3. Acquire knowledge about transient stability studies
4. Analyse semi, full and buck & boost converters
5. Acquire knowledge about time and frequency response of the system

List of Experiments:

1. Determination of power angle diagram for Salient and Non-salient pole synchronous machine.
2. Frequency response characteristics using Bode plot
3. Root Locus & Nyquist method
4. Design of lag, lead and lag-lead compensator
5. Computation of line parameters
6. Modeling of Transmission Lines
7. Load Flow Studies.
8. Fault Analysis.
9. Transient stability studies.
10. Economic load dispatch.
11. Load Frequency control of single-area and two-area systems
12. Single-phase semi-converter with R and RL loads
13. Single-phase full-converter with R and RL loads
14. Analysis of Buck and Buck-Boost converter

Note: At least **TEN** experiments should be conducted in the Semester

With effect from the academic year 2021-22

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-VII

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC25**	Power System Protection	3	-	-	3	30	70	3
2	**18EEC26**	Electrical Drives	3	-	-	3	30	70	3
3	**18EEC27**	Signals & Systems	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective-5	3	-	-	3	30	70	3
5	**18XXOYY**	Open Elective-2	3	-	-	3	30	70	3
PRACTICALS									
6	**18EEC28**	Power Systems-II Lab	-	-	3	3	25	35	1.5
7	**18EEC29**	Electrical Drives Lab	-	-	3	3	25	35	1.5
8	**18EEC30**	Project: Part-1	-	-	4	-	50		2
		Total	**15**	**-**	**10**	**21**	**250**	**420**	**20**

L: Lecture T: Tutorial P: Practical

CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Core Elective-5
18EEE17	Power System Dynamics and Control
18EEE18	Switch Mode Power Converters
18EEE19	Electrical Machine Design
18EEE20	High Voltage Engineering

Course Code	Open Elective-2
18MEO03	Research Methodologies
18MEO04	Entrepreneurship
18EGO01	Technical Writing Skills
18CSO04	Basics of Data Science using R
18CSO07	Basics of Cyber Security

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18EEC28 **POWER SYSTEMS-II LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
CIE	25 Marks
Credits	1.5

Course Objectives:

1. To simulate and understand the load flows, Fault Analysis of power system.
2. To understand the transient stability studies, Economic power scheduling and Load frequency control in power system.
3. To understand the importance of protective relay kits and also study the various components in substations

Course Outcomes: After completion of this course, students will be able to:

1. Apply the load flow studies for any given power system.
2. Analyze the fault in the real time power system.
3. Estimate the consequences of transient stability, economic power scheduling and load frequency control.
4. Examine function of different types of relays for different power system applications.
5. Illustrate the functionality of each component in the substation.

List of Experiments

1. Simulation of Load Flow Studies
2. Simulation of Fault Analysis.
3. Simulation of Transient stability studies.
4. Simulation of Economic power scheduling.
5. Simulation of Load Frequency control of one area system.
6. IDMT characteristics of Over-current relay.
7. Differential protection of 1-phase transformer.
8. Draw the Characteristics of Static relays.
9. Operation of relays in long transmission line.
10. Over Current & Earth Fault Relay Testing Kit (Static Type)
11. Study of Universal Relay Testing Kit
12. Generator Differential Protection Study Unit
13. Study of Distance Relay Testing Kit / Impedance Relay kit
14. Visiting nearby substation and submitting the report.

Note: At least **TEN** experiments should be conducted in the semester.

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2018-19)

B.E (Electrical and Electronics Engineering)

SEMESTER-V

S.No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			
			Hours per week		Duration in Hours	Maximum Marks		Credits
			L/T	P/D		CIE	SEE	
THEORY								
1.	**16EEC15**	Power Systems – II	3/1	-	3	30	70	4
2.	**16EEC16**	Electrical Machinery – II	3/1	-	3	30	70	4
3.	**16EEC17**	Power Electronics	4	-	3	30	70	4
4.	**16EEC18**	Linear Control Systems	3/1	-	3	30	70	4
5.	**16EEEXX**	Program Specific Elective-1	3	-	3	30	70	3
PRACTICALS								
6.	**16EEC19**	Electrical Machinery – II Lab	0/1	2	3	25	50	2
7.	**16EEC20**	Power Electronics Lab	0/1	2	3	25	50	2
8.	**16EEC21**	Linear Control Systems Lab	0/1	2	3	25	50	2
			22	**06**	**-**	**225**	**500**	**25**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Course Code	Program Specific Elective-1
16EE E01	Non Conventional Energy Sources (NCES)
16EE E02	Electrical Engineering Materials (EEM)
16EE E03	Electronic Instrumentation (EI)
16MT E01	Statistical and Numerical Methods (SNM)
	Courses offered to other Departments
16EE E04	Electrical Technology (for BE3/4, ECE, V-SEM) (Elective)
16EEC22	Electrical Machines and Microcontroller Applications Lab (Core) (for BE3/4, Mech & Prod, V-SEM)

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16EE E03

ELECTRONIC INSTRUMENTATION SYSTEMS

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course objectives: The objective of the course is

1. Understand the concept of transducers.
2. Know the principles of data converters.
3. Understand construction and working details of different signal generators & signal analyzers.
4. Describe various digital frequency and time related measurements.
5. Illustrate automatic instrumentation systems.
6. Know the fundamentals of different CRO's.

Course Outcomes: After completion of this course, the student will be able to

1. Choose appropriate transducer for a given application
2. Design data converters to the required specifications.
3. Estimate the distortion of a signal.
4. Construct different signal generators.
5. Explain the working of different subsystems of different CRO's
6. Develop/design the automatic instrumentation systems.

UNIT-I

Analog and Digital Measuring Systems: Interfacing Active and Passive Transducers, Amplifiers: Instrumentation amplifiers (Fixed and Programmable gain types and its specifications), Isolation amplifiers (Types and its specifications).
Digital to Analog Converters: R-2R ladder and Inverted ladder DACs. Main DAC specifications. Analog to Digital Converter: R-2R Ladder and Inverted Ladder DACs, Main DAC specifications, Analog to Digital Converters: Parallel (or Flash) ADC successive approximation, ADC Microprocessor compatibility, Dual slope ADC, Principal specifications of an ADC.

UNIT-II

Digital Voltmeters and Multimeters: Simple D.C Voltage attenuator, Current to Voltage converter, Resistance to Voltage Converter, Automatic ranging and Automatic zeroing, RMS detector in DMM and RMS and True RMS, Digital Frequency and Time measurements, Frequency Measurements, Frequency ratio time interval and Pulse width measurements, Scaling and Checking modes. Counting errors, Input signal conditioning, Trigger level, Hysteresis.

UNIT-III

Signal Analysis: Wave Analyzers: Signal analysis and wave Analyzer, Type and Applications. Harmonic Distortion Analyzers: harmonic Distortion, heterodyne

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harmonic Analyzer or Wave meter, Tuned circuit, Fundamental Suppression. Spectrum Analysis: Block Diagram, Phase locked circuit for the local oscillator, Successive limiting type of Log IF amplifier.

UNIT-IV

Signal Generators: Fixed and variable Audio frequency oscillator, Audio frequency sine and square wave generator, function generator, square wave pulse generator, random noise generator, TV sweep generator, marker generator and beat frequency oscillator(BFO). synchronized signal generator interfaced with 488 Bus, relay switched attenuator, IEE 488 Electrical interface.

UNIT-V

Cathode Ray Oscilloscope: Block Diagram, Basic Concepts, Vertical amplifier, Time Base, Trigger Delay line and their role in a CRO, Digital storage Oscilloscope, Magnetic Re orders, Digital Interface for Programmable Instrumentation, Description and Sample examples of Automatic Instrumentation.

Text Books:

1. H .S. Kalsi, "Electronic Instrumentation", TMH publications, 2nd Edition, 2007.
2. A.K.Sawhney, "A Course in Electrical and Electronics Measurements and Instrumentation", Dhanpat Rai & Sons, 4th Edition, 2012.

Suggested Reading:

1. E.W Golding "Electrical Measurements and Measuring Instruments", TMH publications, 2011.
2. Helfrick, Albert D. Cooper, William D, "Modern Electronic Instruments & Measuring Instruments", PHI, 1992.

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AICTE MODEL CURRICULUM

B.E. (ELECTRICAL AND ELECTRONICS ENGINEERING)

SEMESTER-V

Sl. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			
			Hours per week			Duration in Hours	Maximum Marks		Credits
			L	T	P		CIE	SEE	
THEORY									
1	**18EEC14**	Electrical Machines-II	3	-	-	3	30	70	3
2	**18EEC15**	Power Systems-II	3	-	-	3	30	70	3
3	**18EEC16**	Power Electronics	3	-	-	3	30	70	3
4	**18EEEXX**	Core Elective -1	3	-	-	3	30	70	3
5	**18EEEXX**	Core Elective -2	3	-	-	3	30	70	3
6	**18MBC01**	Engineering Economics and Accountant	3	-	-	3	30	70	3
PRACTICALS									
7	**18EEC17**	Electrical Machines-II Lab	-	-	2	2	15	35	1
8	**18EEC18**	Power Systems-I Lab	-	-	2	2	15	35	1
9	**18EEC19**	Power Electronics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**

L: Lecture **T: Tutorial** **P: Practical**

CIE - Continuous Internal Evaluation **SEE - Semester End Examination**

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Course Code	Core Elective-1
18EEE01	Wind and Solar Energy
18EEE02	Optimization Techniques
18EEE03	Electrical Engineering Materials
18EEE04	Electronic Instrumentation

Course Code	Core Elective-2
18EEE05	Simulation Techniques in Electrical Engineering
18EEE06	Energy Conservation & Auditing
18EEE07	Industrial Electrical Systems
18EEE08	Electrical Estimation & Costing

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18EEE04 ELECTRONIC INSTRUMENTATION (Core Elective - 1)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To impart basic knowledge of International Standards for various physical quantities and understanding of measurement systems.
2. To familiarize with many varieties of transducers, measuring instruments, their construction and operating principles.
3. To introduce various types of spectrum analyzers, digital instrumentation with design and also an exposure to some of the prominent bio-medical Instrumentation systems.

Course Outcomes: After the completion of this course, students will be able to:

1. Understand the various standards available for the measurement process.
2. Acquire knowledge on various transducers with the analysis in their working principles.
3. Select an electrical transducer for a given physical quantity measurement.
4. Identify instruments like spectrum analyzer, DSO and other virtual instrumentation techniques such as SCADA for appropriate measurements.
5. Illustrate the applications of various Bio-medical instruments used in healthcare.

UNIT– I

Introduction to Instrumentation: Accuracy and Precision - Conformity and Significant figures, Resolution and Sensitivity, Types of Errors, Loading effect, Absolute errors and Relative errors, Measurement of error combinations, Statistical analysis, Probable error and Limiting errors, Calibration, IEEE standards, Elements of ISO 9001, Quality management standards.

UNIT–II

Transducers-I: Classification of transducers, factors for selection of a transducer, Passive electrical transducers: Strain gauges - gauge factor, types of strain gauges - bonded and un-bonded, rosettes, LVDT-construction and displacement measurement, Capacitive transducer and thickness measurement. Active electrical transducers: Piezo-electric transducer and different modes of operation, photo-conductive, photo-voltaic and photo - emissive transducers, semiconductor stain gauges.

UNIT–III

Transducers-II: Characteristics of sound, pressure, power and intensity levels. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Introduction to Micro-Electro-Mechanical Systems (MEMS)

UNIT – IV

Digital Instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. Delayed time base oscilloscope, Digital storage oscilloscope. Introduction to Virtual Instrumentation, SCADA. Data Acquisition System- block diagram

UNIT–V

Applications of Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders - ECG, EEG, EMG and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Text Books:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, Jan-2015
2. H S Kalsi, "Electronic Instrumentation", 3/e, TMH, July-2017
3. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", TMH, Dec-2017

Suggested Readings:

1. David A. Bell, "Electronic Instrumentation & Measurements" PHI, 2nd Edition, 2003.
2. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003.
3. Leslie Cromwell and F.J. Weibell, E.A. Pfeiffer, "Biomedical Instrumentation and Measurements", PHI, 2nd Ed, 1980.

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