SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution &
Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Electrical and Electronics Engineering

Minutes of 3rd BOS Meeting

(UG)

Venue : Seminar Hall,
Department of EEE,
Sri Manakula Vinayagar Engineering College

Date & Time : 18th August 2021 at 10:00 A.M

Department of Electrical and Electronics Engineering

Minutes of 3rd Board of Studies Meeting (UG)

The Third Board of Studies meeting of Electrical and Electronics Engineering Department was held on **18th August 2021 at 10:00 A.M** in the Seminar Hall, Department of EEE, Sri Manakula Vinayagar Engineering College, with Head of the Department in the Chair.

The following members were present for the BoS meeting

Sl. No	Name of the Member with Designation and official Address	Members as per UGC Norms
1	**Dr.S.Anbumalar** Professor and Head Department of EEE SMVEC,Madagadipet-605107	Chairman
2	**Dr.A.Kavitha** Professor Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (University Nominee)
3	**Dr. P. Lakshmi** Professor Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (Academic Council Nominee)
4	**Dr. J. Kanakaraj** Professor and Head Department of EEE PSG College of Technology (Autonomous) Coimbatore – 641 004.	Subject Expert (Academic Council Nominee)
5	**Er.S. Selva Kumar** Senior Engineer Qualcomm India Private Limited Bengaluru, Karnataka - 560001	Representative from Industry
6	**Er.K.Ramraj** Technical Director LED FORSE India Poornankuppam Puducherry – 605 007.	Postgraduate Alumnus (nominated by the Principal)
7	**Dr. P. Jamuna** Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member

8	**Dr.D.Raja** Associate Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member
9	**Dr.M.Susithra** Associate Professor Department of EEE,SMVEC , Madagadipet-605107	Internal Member
10	**Dr.S.Ganesh Kumaran** Associate Professor Department of EEE, SMVEC, Madagadipet-605107	Internal Member
11	**Mrs. T. Gayathiri** Professor and Head Dept of Mathematics, SMVEC, Madagadipet-605107	Internal Member
12	**Dr.K.Kathikeyan** Associate Professor Dept. of Chemistry, SMVEC, Madagadipet-605107	Internal Member
13	**Mrs.G.Namita** Associate Professor Dept. of English, SMVEC Madagadipet-605107,	Internal Member
14	**Dr.D.Mohan Radheep** Associate Professor Dept. of Physics, SMVEC, Madagadipet-605107	Internal Member
15	**Mr. A. Janagiraman** Assistant Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member

Agenda of the Meeting

1) Confirmation of minutes of 2nd BoS meeting and the Curriculum Structure of B.Tech Electrical and Electronics Engineering of R-2019 and R-2020 Regulations – Modifications if any.

2) To apprise about the Pondicherry University **Regulations R-2013, its curriculum and syllabi followed for** the Present B.Tech., Electrical and Electronics Engineering, Fourth year students admitted in the academic Year 2018-19.

3) To discuss and approve the proposed Curriculum structure and syllabi of IV year, VII and VIII semesters, under Autonomous Regulations (i) R-2019 (ii) R-2020 for the B.Tech – Electrical and Electronics Engineering students admitted in the Academic Year 2019-20 and 2020-2021 respectively.

4) To discuss and approve Academic Calendar for the odd Semester of Academic year 2021-22. Online classes are scheduled for I, III & IV years since 19.07.2021 onwards.

5) To Discuss about the revised Department Quality Objectives

   a. To appoint one retired Professor from reputed institutions as a Department Mentor and to conduct at least one meeting per semester.
   b. To conduct one Faculty Development Programme every semester in core subjects.
   c. To depute at least 1/3rd of the Department faculty for Industrial training every year.
   d. To submit at least one research proposal per faculty every year.

6) Efforts to improve internship opportunities and possible help from BOS members

7) To improve core placement

8) To establish "Industry Advisory Board -To give technology path to the department"

9) To discuss and recommend the panel of examiners to the Academic Council.

Minutes of the Meeting

Dr.S. Anbumalar, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal members and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

BOS / 2021 / EEE / UG / 3.1

Chairman, BoS, apprised the minutes of 2nd BoS, its implementation and then it is confirmed with the approval in 3rd BoS meeting for the incorporation of minor revisions needed as mentioned below.

S. No.	Regulations	Semester	Course Name with Code	Unit	Particulars
1	R2019 & R2020	VIII Professional Elective	Principles of Virtual Instrumentation / U19EEE85 / U20EEE826	-	The professional Elective course (Power Electronics Applications in Power Systems - U19EEE85 / U20EEE826) in eighth semester of R-2019 and R-2020 regulations is replaced by Principles of Virtual Instrumentation in order to avoid the repetition of topics. **(Professional Elective list is given in Annexure- I)**
2	R2020	VIII Professional Elective	Optimization Techniques / U20EEE824	-	The professional Elective course (soft computing Techniques - U20EEE824) in eighth semester of R-2020 regulation is replaced by Optimization Techniques in order to avoid the repetition of topics. **(Professional Elective list is given in Annexure- I)**
3	R2019 & R2020	VI	Embedded system / U19EET61 / U20EET616	III & IV	• In unit III, the Specific programming tool name "KEIL" is removed and it is given as Programming Tools: IDE and Programmer Interface. • In Unit IV, the topic "Clocking and Power Management – I/O handling" is included. **(Given in Annexure- II)**
4	R2019 & R2020	VI	Embedded system lab / U19EEP61 / U20EEP612	-	1. Zig Bee RF module with sensor, I2C and UART interfacing 2. Interfacing audio card

					The above experiments (9th and 10th in the experiments list) are modified with the following experiments as per the industrial member suggestions as given below. 1. Interfacing with PC via UART interface 2. Interfacing EEPROM via I2C. **(Given in Annexure- II)**
5	R2020	V	Control systems Lab / U20EEP511	-	1. Design of P/I/D Controllers for Temperature control system 2. Design of P/I/D Controllers for Level control system The above experiments (9th and 10th in the experiments list) related theory contents are not elaborated in the control system theory course and hence these experiments are modified as given below 1. Stability analysis using routh- hurwitz method 2. Time domain analysis of first order and second order system. **(Given in Annexure- III)**

The above corrections are incorporated and approved by BoS members in 3rd BoS meeting, and the details are given in Annexure - I, II and III.

BOS / 2021 / EEE / UG / 3.2

Chairman, BoS, apprised about the Pondicherry University Regulations R-2013, its curriculum and syllabi followed for the present B.Tech – Electrical and Electronics Engineering, Fourth year students admitted in the Academic Year 2018-19.

The BoS noted the Agenda.

BOS / 2021 / EEE / UG / 3.3

The SMVEC Autonomous Regulations R-2019, R-2020, its curriculum for 1 to 8 semesters and syllabi for 7th and 8th semesters, for B.Tech – Electrical and Electronics Engineering were **discussed** and the following comments were given by BoS members.

S. No.	Regulations	Semester	Course Name with Code	Unit	Particulars
1	R2019 & R2020	VII	Industrial Automation and Control U19EET71 / U20EET720	I	Introduction of PLC and supervisory control and data acquisition (SCADA) have to be removed.
				II	Automation components have to be removed.
				IV	Distributed control system have to be removed.
				-	• PLC can be divided into two units. • SCADA can be divided in to two units

2	R2019 & R2020	VII	Electric And Hybrid Vehicle U19EET72 / U20EET721	I, II, III, IV, V	Units need to be rearranged.
3	R2019 & R2020	VII	Industrial Automation and Control Lab U19EEP72 / U20EEP715	-	No. of SCADA experiments needs to be increased.
4	R2019 & R2020	VII	Electric and Hybrid Vehicle Lab U19EEP73 / U20EEP716	-	• Experiment 4: Electrical power requirement for motor can be changed as sizing of motor for electric vehicles. • Experiment 10: battery Type can be changed as Lithium-ion battery.
5	R2019 & R2020	VII Professional Elective	Distributed Generation and Micro Grid U19EEE72 / U20EEE716	III	Suggested to include Island and Stability concepts
				IV	Suggested to include Reactive and Active Power.
6	R2019 & R2020	VII Professional Elective	Power Electronics for Renewable Energy Systems U19EEE73 / U20EEE718	I	Suggested to remove the term construction, working of induction generator (IG) and replace with Modelling and analysis of IG.
				II	Suggested to remove the term energy storage.
7	R2019 & R2020	VII Professional Elective	Power System Operation and Control U19EEE74 / U20EEE719	II	Suggested to reduce the content, up to single area is enough.
				IV, V	Suggested to remove unit -V and split unit IV as two units (Unit Commitment and Economic Dispatch).
8	R2020	VII Professional Elective	Advanced Control Systems U20EEE717	I	Suggested to remove Unit-I (state variable analysis), since students used to study in LCS.
				I	Suggested to include the state variable design
				II, III	Suggested to Split unit-2 non-linear systems into Two Units (Unit 2 and Unit 3).
				IV	Suggested to remove optimal control.
				IV, V	Suggested to split Unit 5-sampled data analysis into Two Units (Unit 4 and Unit 5).
9	R2019 & R2020	VIII	Protection and Switchgear U19EET81 / U20EET822	II	Rename the unit name as Relays instead of Electromagnetic relays
				II	Suggested to Include IDMT relay topic
				V	Current Limiting reactor and Insulation coordination has to be added
10	R2019 & R2020	VIII Professional Elective	Power System Economics U19EEE80 / U20EEE821	I	Suggested to include regulatory policies
				V	Suggested to include carbon credits.
11	R2019 & R2020	VIII Professional Elective	EHV AC and DC Transmission U19EEE86 / U20EEE827	I	Suggested to include Substation equipments

12	R2019 & R2020	VIII Professional Elective	Restructured Power System U19EEE87 / U20EEE828	I	The topic “Role of Independent system operator” needs to be verified. It is referred from Pondicherry University syllabus and so it is not altered.
13	R2019 & R2020	VIII Professional Elective	Power system stability U19EEE88 / U20EEE829	I, II, III, IV, V	Entire syllabus need to be rearranged and the unit flow may be Introduction, Small signal stability, Transient stability, voltage stability. Refer "Kundur" book for reference.
14	R2020	VIII Professional Elective	Optimization Techniques U20EEE824	I, II, III, IV, V	Suggested to rearrange the syllabus by refereeing S.S.Rao.
15	R2020	VIII Professional Elective	Robotics And Control U20EEE830	II	The title can be of “MODELING OF ROBOTS” Instead of “Mathematical Modeling and sensors”
				IV	Suggested to verify the topics “Path Planning: Point - To - Point Motion – Motion Through sequence of Points”

The above corrections are incorporated and the Syllabi (Given in Annexure- IV) are approved by the BoS members.

BOS / 2021 / EEE / UG / 3.4

The Academic Calendar which includes the CAT, model exam schedules and internal marks distributions for the odd/even Semester of Academic year 2021-22 **(given in Annexure-V) were discussed and approved**.

- The classes are scheduled in the online mode for I, III years since 19.07.2021 onwards and for the final years yet to start in the month of September 2021.

BOS / 2021 / EEE / UG / 3.5

The revised Department Quality Objectives were discussed and the **BoS noted the Agenda.**

- To appoint one retired Professor from reputed institutions as a Department Mentor and to conduct at least one meeting per semester.
- To conduct one Faculty Development Programme for every semester in core subjects.
- To depute at least 1/3rd of the Department faculty for Industrial training every year.
- To submit at least one research proposal per faculty for every year.

BOS / 2021 / EEE / UG / 3.6

The efforts to improve internship opportunities were discussed and the **BoS noted the Agenda.**

- More number of companies can be invited to recruit students as interns.
- The internships can be done through online portals like https://internship.aicte-india.org/, www.intershala.com, etc in this pandemic situation.
- The relatives of students those who are working in the core companies should be identified and the internship opportunities should be provided to the students.

BOS / 2021 / EEE / UG / 3.7

Various steps to be taken to improve core placement were discussed and the **BoS noted the Agenda.**

- Planned to prepare a list of core companies and to find out the recent technologies they are involved. Organizing training to the students as a value addition in the recent technologies used by the targeted companies.

- Planned to circulate the department brochure along with the students achievements to the core companies to market the student's skills.
- Students are motivated to do more industrial projects, so as to improve the core placement
- The industrial person is in the "Board of studies" and the suggestions are considered to incorporate the industrial requirement into the curriculum.
- As on date the alumni meet is conducted once in a year, to get the feedback about our curriculum and syllabi and other activities. Planning to conduct the alumni meet twice in a year and also the alumni those who are working in core industries will be identified and their suggestions will be incorporated to improve the core placement.
- Planning to organize Industry -Institute exchange programs.

BOS / 2021 / EEE / UG / 3.8

Establishment of "Industry Advisory Board in the department to give technology path to the department were discussed and the **BoS noted the Agenda.**

The Industrial Advisory Board (IAB) is planned to constitute for EEE Department comprising of representatives from various industries, thereby generating a mechanism for providing precious and valuable inputs to the department to strengthen the curriculum and delivery strategies.
IAB is intended to help to initiate close interaction between the institute and the industry and is serving as the platform for showcasing best practices, latest technological advancements and their implementation. Through IAB, we expect to improve the quality of technical education adequately and meet the needs of the industry and academia based on cross-fertilization of ideas for systems improvement.

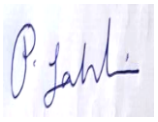
This Industrial Advisory Board will serve following objectives:

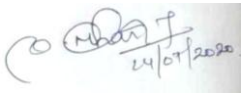
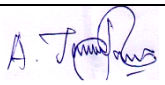
- Bridge the gap between Industry and Academia and also strengthening the ties.
- More intense and effective implementation of interaction channels like industrial visits, faculty and student internships, industry projects, training and consultancies.
- Offering more and more industry relevant courses through curriculum.
- Fostering entrepreneurship by facilitating expertise.

BOS / 2021 / EEE / UG / 3.9

The list of question paper setters and Evaluators **(given in Annexure-VI)** was presented and recommended by the BoS members to the academic council.

The meeting for IV year syllabi approval was concluded at 12.45 PM by **Dr. S.Anbumalar**, Chairman, Board of Studies, Department of Electrical and Electronics Engineering, Sri Manakula Vinayagar Engineering College.

Sl.No	Name of the Member with Designation and official Address	MEMBERS AS PER UGC NORMS	Signature
1	**Dr.S.Anbumalar** Professor and Head Department of EEE SMVEC,Madagadipet-605107	Chairman	
2	**Dr.A.Kavitha** Professor, Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (University Nominee)	
3	**Dr. P. Lakshmi** Professor, Department of EEE College of Engineering Guindy Anna University Chennai. 600 025.	Subject Expert (Academic Council Nominee)	

4	**Dr. J. Kanakaraj** Professor & Head Department of EEE PSG College of Technology (Autonomous) Coimbatore – 641 004.	Subject Expert (Academic Council Nominee)	
5	**Er.S. Selva Kumar** Senior Engineer Qualcomm India Private Limited Bengaluru, Karnataka - 560001	Representative from Industry	
6	**Er.K.Ramraj** Technical Director LED FORSE India Poornankuppam Puducherry – 605 007.	Postgraduate Alumnus (nominated by the Principal)	
7	**Dr. P. Jamuna** Professor Department of EEE,SMVEC	Internal Member	
8	**Dr.D.Raja** Associate Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member	
9	**Dr.M.Susithra** Associate Professor Department of EEE,SMVEC , Madagadipet-605107	Internal Member	
10	**Dr.S.Ganesh Kumaran** Associate Professor Department of EEE, SMVEC, Madagadipet-605107	Internal Member	
11	**Dr.T.Gayathri** Professor and Head Dept of Mathematics,SMVEC, Madagadipet-605107	Internal Member	
12	**Dr.K.Kathikeyan** Associate Professor Dept. of Chemistry, SMVEC, Madagadipet-605107	Internal Member	
13	**Mrs.G.Namita** Associate Professor Dept. of English, SMVEC Madagadipet-605107,	Internal Member	
14	**Dr.D.Mohan Radheep** Associate Professor Dept. of Physics, SMVEC, Madagadipet-605107	Internal Member	
15	**Mr. A. Janagiraman** Assistant Professor Department of EEE,SMVEC, Madagadipet-605107	Internal Member	

Annexure – I

(a. PROFESSIONAL ELECTIVE COURSES – R-2019)

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE41	Electrical Safety Engineering
2	U19EEE42	Computer Aided Design for Electrical Apparatus
3	U19EEE43	Sensors and Transducers for Electrical Engineering
4	U19EEE44	Finite Element Analysis
5	U19EEE45	Energy Storage Technology
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE51	Utilization of Electrical Energy
2	U19EEE52	Renewable Energy Sources
3	U19EEE53	Electrical Energy Audit and Conservation
4	U19EEE54	Automotive Electronics for Electrical Engineering
5	U19EEE55	Industrial Electrical System
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE61	Smart Grid
2	U19EEE62	High Voltage Engineering
3	U19EEE63	Special Electrical Machines
4	U19EEE64	Digital Signal Processing
5	U19EEE65	Electric Drives
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE71	Communication Engineering
2	U19EEE72	Distributed Generation and Microgrids
3	U19EEE73	Power Electronics for Renewable Energy Systems
4	U19EEE74	Power System Operation and Control
5	U19EEE75	SMPS and UPS
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U19EEE80	Power System Economics

2	U19EEE81	Modern Power Electronic Converters
3	U19EEE82	Electric Traction
4	U19EEE83	Soft Computing Techniques
5	U19EEE84	Fundamentals of Solar photovoltaic system and applications
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	**U19EEE85**	**Principles of Virtual Instrumentation**
2	U19EEE86	EHV AC and DC transmission
3	U19EEE87	Restructured Power System
4	U19EEE88	Power System Stability
5	U19EEE89	Robotics and Control

Annexure – I
(b. PROFESSIONAL ELECTIVE COURSES – R-2020)

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE401	Electrical Safety Engineering
2	U20EEE402	Computer Aided Design for Electrical Apparatus
3	U20EEE403	Sensors and Transducers for Electrical Engineering
4	U20EEE404	Finite Element Analysis
5	U20EEE405	Energy Storage Technology
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE506	Utilization of Electrical Energy
2	U20EEE507	Electrical Traction
3	U20EEE508	Electrical Energy Audit and Conservation
4	U20EEE509	Automotive Electronics for Electrical Engineering
5	U20EEE510	Industrial Electrical System
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE611	Smart Grid
2	U20EEE612	High Voltage Engineering
3	U20EEE613	Electric Drives
4	U20EEE614	Digital Signal Processing
5	U20EEE615	Fuzzy and Neural Systems
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE716	Distributed Generation and Microgrids
2	U20EEE717	Advanced Control Systems
3	U20EEE718	Power Electronics for Renewable Energy Systems
4	U20EEE719	Power System Operation and Control
5	U20EEE720	Special Electrical Machines
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U20EEE821	Power System Economics
2	U20EEE822	FACTS
3	U20EEE823	SMPS and UPS
4	**U20EEE824**	**Optimization Techniques**
5	U20EEE825	Fundamentals of Solar photovoltaic system and applications
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	**U20EEE826**	**Principles of Virtual Instrumentation**
2	U20EEE827	EHV AC and DC transmission
3	U20EEE828	Restructured Power System
4	U20EEE829	Power System Stability
5	U20EEE830	Robotics and Control

Annexure – II

(a. Revised syllabus for "EMBEDDED SYSTEM")

		L	T	P	C	Hrs
U19EET61 / U20EET616	**EMBEDDED SYSTEM**	**3**	**0**	**0**	**3**	**45**

Course Objectives

- To gain knowledge about the fundamentals of embedded systems and its communication protocols.
- To understand the architectural features of ARM Cortex M series Controller.
- To learn about the different programming techniques for ARM Cortex M series Controller
- To impart knowledge on ARM Cortex M series Controller peripherals with device driver and its interface circuits
- To provide a platform for the student to design, implement, integrate, and develop software and hardware applications with the real time system.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the basic building process of embedded system.**(K2)**
CO2 - Analyze any type of Microcontroller Architecture in detail.**(K4)**
CO3 - Apply the instruction sets to program ARM Cortex M0 using Embedded C in IDE software. **(K3)**
CO4 - Provides the experience to integrate hardware and software for any microprocessor / microcontroller for product designing such as smart-phones, microcomputers etc. **(K4)**
CO5 - Impart the concepts of RTOS in accessing shared resources for optimized CPU performance, timing based operations, video streaming and audio streaming etc. **(K3)**

UNIT I OVERVIEW OF EMBEDDED SYSTEMS (9 Hrs)

Basics of Embedded Systems – I/O Devices: Types and Examples – Synchronous and Synchronous and Asynchronous Communication – Serial Communication devices and Protocols: I^2C, SPI, UART - Parallel Device Ports.

UNIT II ARM ARCHITECTURE (9 Hrs)

ARM Programmer's model - Registers – Processor modes - Pipeline - Interrupts – ARM organization - ARM Cortex M series Controller families – Instruction sets – Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions – ARM Memory Management Unit.

UNIT III ARM CORTEX M SERIES CONTROLLER PROGRAMMING (9 Hrs)

Writing and optimizing the embedded C Code – Profiling and Cycle Counting – Instruction Scheduling –Register Allocation – Conditional Execution – Looping Constructs – Bit Manipulation - Timers and counters - Watchdog timer. **Programming Tools: IDE and Programmer Interface.**

UNIT IV ARM CORTEX M SERIES CONTROLLER PERIPHERALS (9 Hrs)

Clocking and Power Management – I/O handling - SPI and I^2C – UART – Analog to Digital conversion – temperature sensor – light sensor– accelerometer - Digital to Analog conversion – Digital sensors

UNIT V RTOS FOR EMBEDDED SYSTEMS (9 Hrs)

Introduction to RTOS - Task and Task Scheduler - Scheduling policies – Interrupt Service Routines – Inter process communication mechanisms – Design issues- Introduction to Microcontroller/ Operating System.

Textbooks

1. Agus Kurniawan, "Getting Started With STM32 Nucleo Development", Agus Kurni, 1st Edition, 2016.
2. Sepehr Naimi, Sarmad Naimi, Muhammad Ali Mazidi, "The STM32F103 Arm Microcontroller and Embedded Systems-Using Assembly and C", Microdigitaled, 1st Edition, 2020.
3. Brian Amos, "Hands-On RTOS with Microcontrollers: Building Real-time Embedded Systems Using FreeRTOS, STM32 MCUs, and SEGGER Debug Tools", Thomas Learning, 1st Edition, 2020.
4. *Geoffrey Brown, "Discovering the STM32 Microcontroller", Indiana University, Free Edition, 2016.*

Reference books

1. *Yifeng Zhu, "Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language", E-Man Press LLC, 2nd Edition, 2016.*
2. *Elicia White, "Making Embedded Systems", O' Reilly Series, 1st Edition, 2011.*
3. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides - Designing and Optimizing System Software", Elsevier, 2008.
4. *Peckol, "Embedded system Design", John Wiley and Sons, 2nd Edition, 2010.*
5. Frank Vahid, "Embedded System Design–A Unified Hardware and Software Introduction", John Wiley, 1st Edition, 2002.

Web References

1. https://www.tutorialspoint.com/embedded_systems/es_overview.htm
2. https://developer.arm.com/architectures/learn-the-architecture/introducing-the-arm-architecture/single-page
3. https://www.coursera.org/lecture/iot/lecture-1-1-what-are-embedded-systems-Gah7g
4. https://nptel.ac.in/courses/108102045/
5. https://www.eeweb.com/app-notes/tags/arm
6. https://en.wikibooks.org/wiki/Embedded_Systems/Real-Time_Operating_Systems

Annexure – II

(b. Revised syllabus for "EMBEDDED SYSTEM LAB")

		L	T	P	C	Hrs
U19EEP61 / U20EEP612	**EMBEDDED SYSTEM LAB**	**0**	**0**	**2**	**1**	**30**

Course Objectives

- To study and Identify hardware and software components to build an embedded system.
- To demonstrate the interfacing of peripherals with ARM Cortex M series microcontroller.
- To understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.
- To gain knowledge and design of microcontroller based embedded system.
- To create a real-time system for particular applications.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the working of ARM Cortex M series microcontroller, FPGA, and raspberry pi. **(K3)**

CO2 - Interface ARM Cortex M series microcontroller, FPGA, and raspberry pi Microcontrollers with external Peripheral devices. **(K4)**

CO3 - Handle interrupts for real time control applications using ARM Cortex M series Controller. **(K4)**

CO4 - Generate PWM signals for motor control applications. **(K4)**

CO5 - Design and develop interface between controller and device. **(K4)**

LIST OF EXPERIMENTS

1. Study on ARM Cortex M series Controller starter kit

   Conduction of following experiments using ARM Cortex M series Controller

   2. Interfacing ADC and DAC
   3. Interfacing real time clock
   4. Interfacing Keyboard and LCD
   5. Interfacing SPI Flash with interrupt
   6. Interfacing of PWM based LED lighting board
   7. Interfacing DC motor
   8. Interfacing temperature sensor
   9. **Interfacing with PC via UART interface**
   10. **Interfacing EEPROM via I2C**

11. Study on FPGA developer board for PWM generation
12. Study on Raspberry pi for IoT application
13. Study on Real Time Operating Systems

Reference Books

1. Agus Kurniawan, "Getting Started With STM32 Nucleo Development", Agus Kurni, 1st Edition, 2016.
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3. Brian Amos, "Hands-On RTOS with Microcontrollers: Building Real-time Embedded Systems Using FreeRTOS, STM32 MCUs, and SEGGER Debug Tools", Thomas Learning, 1st Edition, 2020.
4. *Geoffrey Brown, "Discovering the STM32 Microcontroller", Indiana University, Free Edition, 2016.*
5. Raj Kamal, "Embedded Systems-Architecture, Programming and Design", Tata McGraw Hill, 3rd Edition, 2017.
6. Lyla B. Das, "Embedded Systems-an integrated approach", Pearson Education, 1st Edition, 2013.
7. K.V. Shibu, "Introduction to Embedded Systems", Tata McGraw Hill, 2nd Edition, 2016.
8. Michael J. Pont, "Embedded C", Addison Wesley, 1st Edition, 2002.
9. David E. Simon, "An Embedded Software Primer", Pearson Education, 1st Edition, 2012.

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6. https://developer.arm.com/architectures/learn-the-architecture/introducing-the-arm-architecture/single-page
7. https://www.eeweb.com/app-notes/tags/arm
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Annexure – III

(Revised syllabus for "CONTROL SYSTEMS LAB")

U20EEP511	CONTROL SYSTEMS LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To provide the concepts of modeling and simulation of physical systems.
- To provide adequate knowledge in time response of systems and error analysis.
- To give basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.
- To understand the concept of stability and its analysis.
- To get adequate knowledge about practical tuning of P/I/D controllers for motors/converters.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Interpret different electrical and mechanical systems with its modeling. **(K2)**
CO2 - Use the time domain analysis, to predict stability of a system performance of the system. **(K3)**
CO3 - Demonstrate frequency domain analysis of a system. **(K3)**
CO4 - Familiarize with the tuning procedure of P/I/D controllers for converter/motor applications. **(K4)**
CO5 - Design a controller for any system to meet the desired performance. **(K4)**

List of Experiments

1. Mathematical modeling and simulation of physical systems
    - Mechanical
    - Electrical
2. Simulation of a RC lead/lag compensating network /second order systems for the given specifications and to obtain its frequency response.
3. Determinations of Transfer function of a separately excited DC Motor.
4. Design and implementation of PID controller for DC motor
5. Stability analysis of a system using Root Locus
6. Determination of transfer functions of a physical system using frequency response and Bode's asymptotes.
7. Position and speed control of DC servo motor
8. Design of Lead/Lag/Lead-Lag Compensator for DC Motor
9. **Stability analysis using routh- hurwitz method**
10. **Time domain analysis of first order and second order system**
11. Simulation of Controllability and Observability of a system
12. Simulation of open loop and closed loop speed control of 3 phase induction motor.
13. Simulation of open loop and closed loop control DC buck converter.

Reference Books

1. Hasan Saeed, "Automatic Control Systems (With Matlab Programs)", S. K. Kataria & Son, 1st Edition, 2010.
2. I. J. Nagarath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 6th Edition, 2018.
3. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 5th Edition, 2015.
4. Benjamin C. Kuo, "Automatic Control Systems", PHI Learning Private Ltd., 9th Edition, 2014.

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2. https://www.quanser.com/solution/control-systems/
3. http://ncr.mae.ufl.edu/papers/te02.pdf
4. https://futureengineering.in/control-system-lab/
5. http://vlabs.iitb.ac.in/vlab/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	3	-	-	-	2	2	3
2	3	3	3	3	3	-	-	-	3	-	-	-	2	2	3
3	3	3	3	3	3	-	-	-	3	-	-	-	2	2	3
4	3	3	3	3	3	-	-	-	3	-	-	-	2	2	3
5	3	3	3	3	3	-	-	-	3	-	-	-	2	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Annexure – IV

IV year syllabi - VII & VIII semesters

U20EET720 / U19EET71	INDUSTRIAL AUTOMATION AND CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To apprehend the basic architecture of Industrial automation system.
- To explain the operation of PLC and its hardware components.
- To practice the ladder logic programming of PLC's.
- To describe the working and control of SCADA
- To explain the HMI components and its functions.

Course Outcomes

After completion of the course, the students will be able to

CO1- Analyze type of Automation system and its architecture in detail.**(K2)**
CO2- Discuss history of PLC, its sequence of operation and the hardware components.**(K2)**
CO3 - Illustrate the wiring diagram and ladder logic diagrams used in PLC.**(K3)**
CO4 -Acquire knowledge about the operation of SCADA and its sub-systems.**(K2)**
CO5 - Demonstrate the fundamentals of Human-Machine Interface. **(K2)**

UNIT I INTRODUCTION TO AUTOMATION (9 Hrs)

Automation overview – requirement of automation systems – architecture of industrial automation system – Levels of Automation-basic elements of an automated system – industrial bus systems: modbus and profibus.

UNIT II PROGRAMMABLE LOGIC CONTROLLERS (9 Hrs)

Introduction to PLC, Principles of Operation - Size and Application. Hardware Components: I/O Section, Discrete /Analog I/O Modules, Special I/O Modules, CPU, Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data,

PLC Programming: Processor Memory Organization, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Ladder Diagram.

UNIT III LADDER LOGIC PROGRAMMING (9 Hrs)

PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manual/Mechanical Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay /Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.

UNIT IV SCADA FUNDAMENTALS (9 Hrs)

Introduction, Open system: Need and advantages, Building blocks of SCADA systems, RTU-Evolution, Components, Communication, Logic, Termination and Testing and HMI subsystem - Power supplies, Advanced RTU functionalities, IEDs, Data concentrators and merging units.

Master Station: Software /Hardware components, Server systems in the master station, Small, medium, and large master stations, GPS.

UNIT V HUMAN-MACHINE INTERFACE (9 Hrs)

HMI components, software functionalities, Situational awareness, Intelligent alarm filtering: Need and technique, Alarm suppression techniques, Operator needs and requirements, SCADA Systems: Classification – implementation - system hardware/ software.

Text Books

1. Frank D. Petruzella, "Programmable Logic Controllers", McGraw Hill, 4th Edition , 2011
2. Mini S. Thomas, "Power System SCADA and Smart Grids",CRC Press;3rd edition April 2015.
3. S. Mukhopadhyay, S. Sen and A. K. Deb, "Industrial Instrumentation, Control and Automation", Jaico Publishing House, 1st Edition, 2013.

Reference Books

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Cengage Learning, 3rd India Edition, 2007.
2. Frank lamb, "Industrial Automation: Hands On", McGraw-Hill Education, 1st Edition, 2013.
3. T. Huges, "Programmable Logic Controllers", ISA press, 1994.
4. William T. Shaw, "Cyber security for SCADA systems", Penn Well Books, 2006.

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1. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/plc-ladder-sequential-programming
2. https://www.beckhoff.com/english.asp?start/?pk_campaign=AdWords-AdWordsSearch-IndustrialAutomationEN&pk_kwd=industrial%20automation
3. https://www.advantech.com/solutions/ifactory
4. https://www.plantautomation-technology.com/articles/an-overview-of-distributed-control-systems-dcs
5. https://www.controleng.com/articles/scada-remains-relevant-for-industrial-automation/
6. https://sw.aveva.com/monitor-and-control/scada

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EET721 / U19EET72	ELECTRIC AND HYBRID VEHICLE	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To familiarize with the fundamental concepts of electric vehicle
- To explain the concept of hybrid electric vehicle architecture, its component sizing.
- To determine thedrives suitable for electric vehicles.
- To acquaint the design concepts of electric vehicle.
- To overview the energy storage technologies used for electric and hybrid vehicle.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Summarize the basics of electric vehicle **(K2)**
CO2 - Combine the different energy storage and their technologies on implementing hybrid vehicle. **(K3)**
CO3 - Organize suitable drive for developing a hybrid electric vehicle. **(K2)**
CO4 -Familiarize with the design concepts of electric vehicle **(K2)**
CO5 -Describe the working of different configurations of hybrid vehicles. **(K2)**

UNIT I INTRODUCTION TO EV (9 Hrs)

History of hybrid and electric vehicles - social and environmental importance - impact of modern drive - trains on energy supplies - Fundamentals of vehicle propulsion and Braking: Dynamic Equation - Vehicle Power Plant and Transmission Characteristics - Vehicle Performance.

UNIT II HYBRID VEHICLE (9 Hrs)

Classification - Series and Parallel HEVs - Advantages and disadvantages - Series-Parallel Combination - Internal Combustion Engines: Reciprocating Engines - Gas Turbine Engine- Design of an HEV: Hybrid Drive train - Sizing of Components.

UNIT III ELECTRIC PROPULSION DRIVE SYSTEMS (9 Hrs)

Electric drives used in EV/HEV: Induction motor drives - DC motor drives - Permanent magnet motor drives - their Configuration - Control and Applications in EV/HEV.

UNIT IV DESIGN OF ELECTRIC VEHICLE (9 Hrs)

Components of EV - advantages - EV transmission configuration: Transmission components - gear ratio - EV motor sizing - EV market.

UNIT V ELECTRIC VEHICLE STORAGE TECHNOLOGY (9 Hrs)

Battery Types - Parameters - Technical characteristics – modelling and equivalent circuit - Methods of battery charging - Fuel cells: Types - Fuel cell electric vehicle – Ultra capacitors - Hydrogen storage systems – Flywheel technology.

Text Books

1. MehrdadEhsani, YiminGao, SebastienE.Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press, 3rd Edition, 2019.
2. IqbalHussain, “Electric and Hybrid Vehicles – Design Fundamentals”, CRC Press, 2nd Edition, 2011.

Reference Books

1. K. T. Chau, “Electric vehicle machines and drives: Design, analysis and application”, John Willey and Sons Singapore pte. ltd., 1st Edition, 2015.
2. M. Ehsani, Y. Gao and A. Emadi, “Modern electric, hybrid electric and fuel cell vehicles: Fundamentals, Theory and design”, CRC press, 2nd Edition, 2011.
3. J. Larminie and J. Lowry, “Electric vehicle technology explained”, John Willey & Son ltd., 2nd Edition, 2012.
4. I. Husain, “Electric and hybrid vehicles: Design fundamentals”, CRC press, 2003.

Web References

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2. https://www.evgo.com/why-evs/types-of-electric-vehicles/
3. https://www.electrichybridvehicletechnology.com/
4. http://www.ieahev.org/
5. https://www.sae.org/learn/content/acad06/
6. https://www.intechopen.com/books/electric-vehicles-modelling-and-simulations

COs/POs/PSOs Mapping

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	-	3	-	-	-	-	1	2	3	2
2	2	3	3	3	-	-	3	-	-	-	-	1	2	3	2
3	3	3	2	2	-	-	3	-	-	-	-	1	2	3	2
4	3	3	3	2	-	-	3	-	-	-	-	1	2	3	2
5	2	3	3	2	-	-	3	-	-	-	-	1	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20HSP703 / U19EEP71	BUSINESS BASICS FOR ENTREPRENEUR	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop a clear understanding on Business Plans and their significance.
- To be familiar with various forms of business appropriate for an individual entrepreneur
- To understand various ways of judging a successful opportunity for an entrepreneur
- To know the ways to formulate a successful Operation Plan
- To be aware of things to know to prepare effective financial and marketing plans

Course Outcomes

After completion of the course, the students will be able to

CO1 - Impact comprehensive knowledge of an entrepreneurial ecosystem**. (K6)**

CO2 - Understand the need and significance of Business Plan in the success of an Enterprise. **(K2)**

CO3 - Understand the ways to judge the economic and business viability of proposed venture. **(K2)**

CO4 - Utilize the elements of success of entrepreneurial ventures. **(K3)**

CO5 - Evaluate the effectiveness of different entrepreneurial strategies. **(K5)**

UNIT ITHE ENTREPRENEURIAL PERSPECTIVE (6 Hrs)

Entrepreneurship and Family Business Management, Entrepreneurship theory and practice, The Nature and Importance of Entrepreneurs, The Entrepreneurial and Intrapreneurial Mind, The Individual Entrepreneur, International Entrepreneurship Opportunities

UNIT II CREATING AND STARTING THE VENTURE (6 Hrs)

Creativity and the Business Idea, Legal Issues for the Entrepreneur, the Business Plan, the Marketing Plan, the Financial Plan, the Organizational Plan

UNIT III FINANCING THE VENTURE (6 Hrs)

Raising Finance, scaling up the venture, NDA'S and term sheet, Sources of the Capital, Informal Risk Capital and Venture Capital

Report Submission:

- Grooming Entrepreneurial Mind-set
- Interaction with Business Leaders/Bankers/Venture Capitalists
- Finding and evaluating an idea
- Develop a business plan
- Financing for a company start-up
- Setting up a company-legal entity
- Entrepreneurial development and employment creation
- Effects of creativity and innovation on the entrepreneurial performance of family business

Text Books

1. G. Friend &S. Zehle, "Guide to business planning", Profile Books Limited, 2004.
2. Lasher, W. (2010). The Perfect Business Plan Made Simple: The best guide to writing a plan that will secure financial backing for your business. Broadway Books.
3. ArjunKakkar. (2009). Small Business Management: Concepts and Techniques for improving Decisions. Global India Publications.

Reference Books

1. Alexander Osterwalder and Yves Pigneur – Business Model Generation.
2. Arthur R. DeThomas – Writing a Convincing Business Plan.
3. Ben Horowitz – The Hard Thing About Hard Things.
4. Guy Kawasaki – The Art of Start 2.0
5. Hal Shelton – The Secrets to Writing a Successful Business Plan.

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2. https://www.entrepreneur.com/article/200516
3. https://smallbusinessbc.ca/article/how-to-use-viability-to-test-if-you-should-invest-in-your-business/
4. https://www.infoentrepreneurs.org/en/guides/strategic-planning/
5. http://www.marketingmo.com/strategic-planning/marketing-plans-budgets/
6. https://www.mbda.gov/page/loan-documentation

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	1	2	1	1	3	3	2	3	1	2	1	2	1
2	1	2	2	2	2	2	3	3	3	2	1	2	2	2	1
3	1	2	2	1	2	2	3	3	3	3	2	3	1	2	3
4	1	3	2	2	2	2	3	3	3	3	2	3	1	2	2
5	1	3	2	2	2	2	3	3	3	2	2	3	1	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP715 / U19EEP72	INDUSTRIAL AUTOMATION AND CONTROL LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To gain practical knowledge regarding the automation components.
- To perform delay operations using the PLC.
- To gain practical knowledge on interfacing of different sensors, counter, timer, RTD using PLC.
- To equip the students to provide the solution for real time industrial applications.
- To equip the students to develop a fault monitoring system using SCADA.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the ladder logic programs and familiar with the components used for process control.**(K2)**
CO2 - Design PLC-relay logic for the real time applications **(K3)**
CO3 - Implement Industrial batch processing system. **(K3)**
CO4 - Design a SCADA monitoring system forreal time applications.**(K3)**
CO5- Diagnose the faulty part of Power generation and distribution networks, etc. **(K3)**

List of Experiments

Programmable Logic Controller

1. Interfacing of lamp and button with PLC for ON/OFF operation.
2. Perform Delayed Operation Of Lamp By Using Push Button.
3. Multiple push button operation with delayed lamp for ON/OFF operation.
4. Combination of Counter and Timer for Lamp ON/OFF operation.
5. DOL Starter and Star Delta Starter operation by using PLC.
6. PLC based temperature sensing using RTD.
7. Develop/ Execute ladder program for the Control of automatic bottle filling system.
8. Develop/ Execute ladder program for sequential control of DC motor.
9. Develop/ Execute ladder program for automated car parking system or elevator system.

SCADA

1. PLC interface with SCADA and status read / Command Transfer operation
2. Parameter reading of PLC in SCADA
3. Temperature sensing using SCADA
4. Alarm annunciation using SCADA
5. Experiments on Transmission Module
   a. Local Mode
   b. Simulation of Faults
6. Implementation of Distribution automation system using SCADA.

Reference Books

1. S. Mukhopadhyay, S. Sen and A. K. Deb, “Industrial Instrumentation, Control and Automation”, Jaico Publishing House, 1st Edition, 2013.
2. Gary Dunning, “Introduction to Programmable Logic Controllers”, Cengage Learning, 3rd India Edition, 2007.
3. Frank lamb, “Industrial Automation: Hands On”, McGraw-Hill Education, 1st Edition, 2013.
4. T. Huges, “Programmable Logic Controllers”, ISA press, 1994.
5. R. Krishnan, “Electric Motor Drives, Modelling, Analysis and Control”, Pearson Education India, 1st Edition, 2015.
6. Viswanandham, “Performance Modeling of Automated Manufacturing Systems”, PHI, 1st Edition, 2009.
7. Jose A. Romagnoli, AhmetPalazoglu, “Introduction to Process control”, CRC Taylor and Francis group, 3rd Edition, 2020.

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1. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/plc-ladder-sequential-programming
2. https://www.beckhoff.com/english.asp?start/?pk_campaign=AdWords-AdWordsSearch-

IndustrialAutomationEN&pk_kwd=industrial%20automation
3. https://www.advantech.com/solutions/ifactory
4. https://www.plantautomation-technology.com/articles/an-overview-of-distributed-control-systems-dcs
5. https://www.controleng.com/articles/scada-remains-relevant-for-industrial-automation/
6. https://sw.aveva.com/monitor-and-control/scada

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	-	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP716 / U19EEP73	ELECTRIC AND HYBRID VEHICLE LAB	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To determine and explain a comprehension detail of hybrid and electrical vehicle
- To equip the students to test and evaluate the performance of hybrid and electrical vehicle.
- To equip with the implementation of plug-in hybrid technology concept for two-wheeler.
- To familiarize with the software skill required for modeling of Hybrid electrical vehicle.
- To demonstrate the different configurations of electric vehicles, components and energy storage systems.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Estimate electrical motor power requirement for hybrid electrical vehicle. **(K5)**
CO2 - Design and analyze the performance electric and hybrid vehicle.**(K4)**
CO3 - Analyze the performance of Battery charging and discharging. **(K4)**
CO4 - Troubleshoot and test the performance of control circuits, sensors, actuators used in an E-Vehicle**(K4)**
CO5 - Evaluate the electric vehicle performance by mathematical modeling using software. **(K5)**

List of Experiments

1. Study of various components of electric vehicle.
2. Demonstration of wiring layout of electric vehicle.
3. Mathematical modelling of Electric Vehicle.
4. Mathematical modelling of hybrid Electric Vehicle: Calculation of steady state force, Dynamic force, Power train tractive effort, Vehicle acceleration, IC engine power requirement, Sizing of motor for electric vehicles.
5. Speed control of BLDC motor in two wheeler.
6. Speed control of SRM motor in two wheeler.
7. Testing of Sensor and Actuators used in an Electric Vehicle.
8. Design a Control Circuit and power module for BLDC.
9. Design a charging circuit for battery.
10. Mathematical modeling of Lithium ion (Battery charging and discharging calculation) using software.

Reference Books

1. MehrdadEhsani, YiminGao, Sebastien E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles”, CRC Press, 3nd Edition, 2019.
2. IqbalHussain, “Electric and Hybrid Vehicles – Design Fundamentals”, CRC Press, 2nd Edition, 2011.
3. Wei Liu, “Hybrid Electric Vehicle System Modeling and Control”, John Wiley and Sons, 2nd Edition, 2017.
4. James Larminie, “Electric Vehicle Technology Explained”, John Wiley and Sons, 1st Edition, 2003.
5. SandeepDhameja, “Electric Vehicle Battery Systems”, Newnes, 1st Edition, 2000.

Web References

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2. https://www.evgo.com/why-evs/types-of-electric-vehicles/
3. https://www.electrichybridvehicletechnology.com/
4. https://www.ieahev.org/
5. https://www.sae.org/learn/content/acad06/
6. https://www.intechopen.com/books/electric-vehicles-modelling-and-simulations

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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3	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
4	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
5	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP717	ELECTRICAL SOFTWARE SIMULATION LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To approach and analyze the Engineering problems using different Simulation software.
- To practice the commands and tools of 2D, 3D drawing, design and drafting of circuit components**.**
- To design and analyze the leakage reactance and flux linkage in a single phase transformer in simulation.
- To practice and explore in electrical simulation software.
- To provide a foundation of Simulation Softwaresfor project works.

Course Outcomes

After completion of the course, the students will be able to

CO1 –Draft the interior and exterior machine models / components in 2D and 3D using simulation software.**(K3)**

CO2 –Design, analyze and optimize the electromagnetic parameters of all the Electrical machines using software.**(K4)**

CO3 –Model and integrate the micro grid system.**(K4)**

CO4 –Determine the transmission line parameters by simulation software.**(K4)**

CO5 –Simulate and analyze the electrical, electronic circuits using appropriate simulation software. **(K3)**

List of Experiments

1. Design of 2D/3D modeling of Simple Sensors and Actuators.
2. Simulation to find leakage reactance of two single phase transformer and determine its leakage reactance ratio.
3. Simulation of flux linkage ratio in the single phase and three phase transformer.
4. Simulation of Three phase thyristor converter.
5. Design of DC Motor Speed controller.
6. Harmonic analysis of non-sinusoidal waveforms.
7. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum
8. Modeling of Micro grid System.
9. Simulation of distributed generation and distributed energy resources to integrate with the micro grid.
10. Simulation of Series and Parallel resonance circuit.
11. Simulation of Fly back DC – DC Converter.
12. Comparison of Frequency Response of a Buck-Boost Converter in CCM and DCM.
13. Switching Characteristics of MOSFET and Diode in a Power-Pole.
14. Simulation of Reactive Power and Power Factor Correction in AC Circuits.
15. Modeling and determination of Transmission Line parameters using simulation software.

Reference Books

1. George Omura, “Mastering AutoCAD 2019 and AutoCAD LT 2019”, SYBEX, 4th Edition, 2019.
2. C. L. Wadhwa, “Electrical Power Systems”, New Age International Pub. Co., 6th Edition, 2018.
3. Peter Campbell, “Permanent Magnet Materials and their Application”, Cambridge University Press, online Edition, 2012.
4. SulaymonEshkabilov,“Beginning MATLAB and Simulink: From Novice to Professional”, Apress, 2nd Edition, 2019.
5. R. Ramshaw and D. Sehauman, “PSpice Simulation of power electronics circuits”, ITP publications, 4th Edition, 2001.
6. Randy H. Shih, “AutoCAD 2019 Tutorial Second Level 3D modeling”, SDC publications, 3rd Edition, 2019.
7. Craig Muller, “PSCAD Power Systems Computer Aided Design”, User manual Manitoba HVDC Research centre, 2010.

Web References

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2. https://thesourcecad.com/how-to-make-2d-from-3d-drawing-in-autocad-using-flatshot/

3. https://www.mentor.com/products/mechanical/magnet/magnet/
4. https://in.mathworks.com/matlabcentral/fileexchange/?s_tid=gn_mlc_fx
5. https://www.mathworks.com/academia/books.html
6. https://www.homerenergy.com/products/pro/index.html
7. https://ece.uwaterloo.ca/~pwr_elec/
8. https://www.orcad.com/pspice-free-trial
9. https://elec-engg.com/pscad-software/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
2	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
3	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
4	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3
5	3	3	3	3	3	–	–	–	1	–	–	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEW701 / U19EEW71

PROJECT PHASE - I

L	T	P	C	Hrs
0	0	4	2	60

Course Objectivise

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To develop their own innovative prototype of ideas.
- To encourage the students to work as a team to solve the engineering problem
- To train the students for the preparation of project reports.
- To train the students to defend reviews and viva voce examination.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify the problem statement for the proposed work through the literature survey. **(K3)**
CO2 -Choose the proper components as per the requirements of the design/system**. (K2)**
CO3 -Apply the acquainted skills to develop final model/system**. (K2)**
CO4 -Estimate, plan and execute the project as a team**. (K3)**
CO5 -Defend the finding and conclude with oral/written reports**. (K2)**

Course Description

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner.

Each team is expected to present their work at National/International conferences. Team that has come out with novel contribution will be encouraged to publish their work in any referred journals.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	3	3	-	1	1	2	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	1	1
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3
4	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3
5	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEW702 / U19EEW72	INTERNSHIP/ INPLANT TRAINING	L	T	P	C	Hrs
		-	-	-	2	-

Students may undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Mentor, Class advisor and Departmental Consultative Committee (DCC)). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period.An Evaluation committee formed by the Head of the Department will review and recommend the grade 100% Continuous Assessment pattern as follows: Internship / Inplant training Report (50 %), Presentation (25 %) and oral Examination (25 %).

U20EEM707	PROFESSIONAL ETHICS	L	T	P	C	Hrs
		2	0	0	-	30

Course Objectives

- To enable the students to create an awareness on Engineering Ethics and Human Values,
- To instill Moral, Social Values and Loyalty and to appreciate the rights of others.
- To develop a firm ethical base.
- To make the students to realize the significance of ethics in professional environment.
- To acquaint students with latest intellectual property rights

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply ethics in society. **(K3)**
CO2 - Discuss the ethical issues related to engineering. **(K2)**
CO3 - Act as a responsible Experimenter and to follow the codes of Ethics. **(K3)**
CO4 - Realize the responsibilities and rights in the society. **(K2)**
CO5 - Familiarize with the Multinational Corporations and its Social Responsibility. **(K3)**

UNIT I HUMAN VALUES (6 Hrs)

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self- confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS (6 Hrs)

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg‘s theory – Gilligan‘s theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION (6 Hrs)

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS SAFETY (6 Hrs)

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES (6 Hrs)

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility

Reference Books

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan. M, Natarajan. S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi,2004.
3. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”,Cengage Learning, 2009
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
6. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, OxfordUniversity Press, Oxford, 2001.
7. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and SocialResponsibility”,McGraw Hill education, India Pvt. Ltd., New Delhi, 2013.
8. World Community Service Centre, “Value Education”, Vethathiri publications, Erode, 2011.

Web References

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

U20EET822 / U19EET81	PROTECTION AND SWITCHGEAR	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the different protection zones and protection schemes in power system.
- To impart knowledge on various types of relays including Distance and differential protection schemes.
- To impart knowledge on protection schemes for generator, transformer, motor, feeder and transmission lines
- To acquire knowledge on various circuit breakers (AC and DC) used in power systems.
- To acquaint the various types of surge protection and earthing.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify the equipment's for protection scheme on Power Systems.**(K2)**
CO2 - Analyze the different applications of the relays in power system.**(K2)**
CO3 - Interpretthe protection of transformer, Bus bar and transmission line.**(K3)**
CO4 - Comprehend the various circuit breakers (AC and DC) used in power system.**(K2)**
CO5 - Analyze the protection against over voltages and working of lightning arrester.**(K2)**

UNIT I PROTECTION SCHEMES (9 Hrs)

Principles and need for protective schemes – Nature and causes of faults – Types of faults – Methods of Grounding - Zones of protection and essential qualities of protection – CTs and PTs and their applications.

UNIT II RELAYS (9 Hrs)

Operating Principles of the Relay - Classification of Relays - Universal relay – Torque equation – R-X diagram. Electromagnetic Relays – Over current, IDMT, Directional, Distance, Differential, Negative sequence and under frequency relays, Introduction to static relays, Phase, Amplitude, Comparators – Synthesis of various relays using Static comparators. Microprocessor relay - Applications

UNIT III APPARATUS AND LINE PROTECTION (9 Hrs)

Generator Capability Curve – Short circuit Calculations – Ground fault and unbalanced current Protection – Over excitation and Abnormal Frequency Protection - Field winding Protection – Loss of Synchronism – Motor Protection, Transformer Protection – Differential, Inrush and Over Current - Bus zone Protection - Protection of Transmission Lines – Concept of Wide Area Monitoring and Protection.

UNIT IV CIRCUIT BREAKERS (9 Hrs)

Functions of switchgear - Principles of arc extinction - Arc control devices - Fuses: types – selection - discrimination – Resistance switching - Recovery voltage and restriking voltage - current chopping and capacitance current breaking – Oil circuit breakers, air break, air blast, and sulphur Hexafluoride and vacuum circuit breakers – HVDC breakers – Rating of Circuit Breaker.

UNIT V SURGE PROTECTION AND EARTHING (9 Hrs)

Causes of overvoltage - Lightning phenomenon – Over voltage due to lightning - Protections against lightning - Lightning arresters – Types - Lightning arrester selection - Surge absorbers – Current limiting reactor - Insulation coordination. Solid, resistance and reactance Earthing - Arc suppression coil - Earthing transformers - Earth wires - Introduction to Indian Electricity rules.

Text Books

1. Sunil S. Rao, "Switch Gear Protections", Khanna Publications, Delhi, 14th Edition, 2019.
2. Bhuvanesh A. Oza, N. C. Nair, R. P. Mehta, V.H. Makwana, "Power System Protection and Switchgear", Tata McGraw - Hill, New Delhi, 1st Edition, 2017.
3. A. Wright, C. Christopoulos, "Electrical Power System Protection", Springer, 2nd Edition, 2013.

Reference Books

1. T. S. MadhavRao, "Power system protection static relays with microprocessor Applications", Tata McGraw hill Publication, 15th Edition, 2015.
2. Badri Ram, D. N. Vishwakarma, "Power System Protection and Switchgear", Tata McGraw Hill, 2nd Edition, 2013.
3. P. M. Anderson, "Power System Protection", Wiley-IEEE publication, 1999.
4. E.T.A. Teta, "Power System Protection, 4 Volumes Set", SBA/IET, 2010.
5. V. K. Mehta, Rohit Mehta, "Principles of Power System" by S. Chand, 4th Revised edition, 2008.

Web References

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2. https://nptel.ac.in/courses/108/107/108107167/
3. https://www.youtube.com/watch?v=_0T2Osgxdxs
4. https://ieeexplore.ieee.org/document/4111891.
5. https://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber
6. https://www.ieee-pes.org/ieee-transactions-on-power-delivery.
7. https://digital-library.theiet.org/content/journals/iet-epa

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	2	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	2	3
4	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
5	3	3	3	3	-	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20HSP804 / U19EEP81	ENTREPRENEURSHIP MANAGEMENT	L	T	P	C	Hrs
		0	0	2	1	30

Course Objectives

- To develop an ability to identify the critical challenges hindering growth of entrepreneurs
- To understand the significance of Finance Skills, Branding, and Sales Skills for an Entrepreneur
- To be aware of various Government Schemes and Subsidies available for Entrepreneurs

Course Outcomes

After completion of the course, the students will be able to

CO1 - Develop and demonstrate the business models. **(K2)**

CO2 -Practice cash management, brand building and enhancing turnover.**(K6)**

CO3 -Understand various schemes and subsidies that are offered by various Government agencies. **(K2)**

CO4 - Effectively tackle growth challenges of their venture.**(K5)**

CO5 - Manage and grow their business in terms of expansion and look for partnerships. **(K3)**

UNIT I ENTRPRENEURIAL SKILLS 1 (6 Hrs)

Introduction to Business Model Generation , Developing Lean Business Model for the Business Idea, Developing Prototype and Evaluating assumptions in Business Model using prototype cheaply, Presentation of Business Model, Business Fair

UNIT II ENTREPRENEURIAL SKILLS 2 (6 Hrs)

Financial Skills – Cash Management – Problems of Poor Cash Management – Learning to be Frugal. Branding – Building a 'niche' follower for your product/service – Developing and Establishing a Brand, Sales skills – KPI of Success of Entrepreneurship – Ensuring Growth in Turnover

UNIT III ENTREPRENEURIAL OPPORTUNITIES (6 Hrs)

Awareness of Government Schemes and Subsidies for various Entrepreneurial Categories – Special Schemes for Women Entrepreneurs – Understanding the Procedure and Documentation Process for availing the Government Schemes – Venture Capital – Crowd funding – Angel Investors.

Report Submission:

- How can I get first 100 customers to pay for my products/services?
- Information technology as a resource
- Marketing skill and promotion for entrepreneurs
- Assessment of factors affecting performance of women entrepreneurs
- Entrepreneurship as a tool for sustainable employment
- Examination of problem facing small scale business
- Survival strategies in small business
- The role of insurance in minimizing business risk

Text Books

1. Storey, D. J., & Greene, F. J. (2010). Small business and entrepreneurship. Financial Times/Prentice Hall.
2. N. M. Scarborough, (2011). Essentials of entrepreneurship and small business management. Prentice Hall
3. Gupta C.B.,&Srinivasan N.P. (2020). Entrepreneurial Development. Sultan Chand and Sons

Reference Books

1. Brian Tracy – The Psychology of Selling.
2. Dale Carnegie – How to Win Friends & Influence People.
3. Robert Kiyosaki and Sharon Lechter – Rich Dad, Poor Dad.
4. Reid Hoffman – The Startup of You: Adapt to the Future, Invest in Yourself, and Transform Your Career.
5. Michael E. Gerber – The E-Myth Revisited.
6. Chris Guillebeau – The Art of Non-Conformity.
7. Eric Ries – The Lean Startup.
8. Kevin D. Johnson – The Entrepreneur Mind.

Web References

1. https://www.helpguide.org/articles/stress/stress-management.htm
2. https://bscdesigner.com/8-entrepreneurial-kpis.htm
3. https://www.inc.com/ilya-pozin/5-problems-most-entrepreneurs-face.html
4. https://www.inc.com/jessica-stillman/how-to-network-with-super-successful-people.html
5. https://www.entrepreneur.com/article/251603
6. https://seraf-investor.com/compass/article/understanding-crowdfunding

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	3	3	-	1	1	2	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	1	1
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3
4	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3
5	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEP818 / U19EEP82	COMPREHENSIVE VIVA	L	T	P	C	Hrs
		0	0	2	1	30

Students will prepare for objective type questions in all core courses during the semester. The viva/exercise shall normally cover the core courses taught in all the semesters of B. Tech Programme. The internal marks for the students are awarded based on the average of all the components conducted for the entire semester. The students are required to take-up an end semester examination and to obtain a minimum mark for grading the required credit. This end semester examination will be conducted to evaluate the critical thinking of the students and at the standard of national level competitive examinations.

U20EEW803 / U19EEW81	PROJECT PHASE - II	L	T	P	C	Hrs
		0	0	16	8	240

Course Objectivise

- To develop the ability to solve a specific problem from its identification to successful solution.
- To develop their own innovative prototype of ideas.
- To encourage the students to work as a team for solving the engineering problems.
- To train the students for review presentation and preparation of project reports.
- To train the students to defend reviews and viva voce examination.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify the problem statement for the project work through the literature survey. **(K3)**
CO2 -Choose the proper components as per the requirements of the design/system**.(K2)**
CO3 -Apply the acquainted skills to develop final model/system**.(K2)**
CO4 -Estimate, plan and execute the project as a team**.(K3)**
CO5 -Defend the finding and conclude with oral/written reports**.(K2)**

Course Description

A Project topic must be selected either from published lists or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner.

Each team is expected to present their work at National/International conferences. Team that has come out with novel contribution will be encouraged to publish their work in any referred journals.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	3	3	-	1	1	2	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	1	1
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3
4	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3
5	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EES809 / U19EES81	SKILL DEVELOPMENT COURSE 9: (NPTEL / MOOC - II)	L	T	P	C	Hrs
		0	0	0	-	-

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator, Class advisor and Subject Experts. Students have to complete the relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the completion of course / marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

U19EEE71	COMMUNICATION ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce different methods of analog communication and their significance.
- To introduce Digital Communication methods for high bit rate transmission.
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication.

Course Outcomes

After completion of the course, the students will be able to

CO1- Comprehend the basic Characteristics of the signals and analog modulation techniques. **(K2)**
CO2- Comprehend needs of modulation and various Digital modulation techniques. **(K3)**
CO3- Illustrate modulation codes and Error Control. **(K3)**
CO4- Describe multiple access techniques. **(K2)**
CO5- Explain the Digital transmission techniques and advanced communication systems. **(K2)**

UNIT I ANALOG COMMUNICATION (9 Hrs)

AM – Frequency spectrum – vector representation – power relations – generation of AM – DSB, DSB/SC, SSB, VSB AM Transmitter and Receiver; FM and PM – frequency spectrum – power relations: NBFM and WBFM, Generation of FM and DM, Amstrong method AND Reactance modulations: FM and PM frequency.

UNIT II DIGITAL COMMUNICATION (9 Hrs)

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding: DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES AND ERROR CONTROL (QUALITATIVE ONLY) (9 Hrs)

Primary communication – entropy, properties, BSC, BEC, source coding: Shaum, Fao, Huffman coding: noiseless coding theorem, BW – SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes: Efficiency of transmissions, error control codes and applications: convolutions and block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES (9 Hrs)

SS and MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)

UNIT V SATELLITE, OPTICAL FIBER – POWERLINE, SCADA (9 Hrs)

Orbits : Types of satellites : frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and INSAT: fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications: SCADA

Text Books

1. Taub&Schiling, “Principles of communication systems”, Tata McGraw hill, 2007.
2. J.Das, “Principles of digital communication”, New Age International, 1986.

Reference Books

1. Simon Haykin, “Communication Systems”, Tata McGraw Hill, 4th Edition.
2. Kennedy and Davis, “Electronic Communication Systems”, Tata McGraw hill, 4th Edition, 1993.
3. Sklar, “Digital Communication Fundamentals and Applications”, Pearson Education, 2001.
4. Baryle, Memuschmidt, “Digital Communication”, Kluwer Publication, 2004.
5. B.P.Lathi, “Modern Digital and Analog Communication Systems”, Oxford University Press, 1998.
6. K. Muralibabu, “Communication Engineering”, Lakshmi Publications, 2013.

Web References

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2. nptel.ac.in/courses/IIT-MADRAS/Principles_of…/pdfs/1_8.pdf
3. yoonc01.tistory.com/attachment/fk100000000032.ppt
4. nptel.ac.in/courses/117101053/
5. nptel.ac.in/courses/117105085/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
2	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1
3	3	3	1	-	1	-	-	-	-	-	1	1	-	1	1
4	3	3	1	-	1	-	-	-	-	-	1	1	-	1	1
5	3	1	1	-	1	-	-	-	-	-	1	1	-	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE716 / U19EEE72	DISTRIBUTED GENERATION AND MICROGRIDS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To study the concepts behind Distributed Generation and Microgrid.
- To illustrate the concept of distributed generation.
- To analyze the impact of grid integration.
- To study and analyse the issues in the Microgrid.
- To learn about scenario of renewable energy scenario.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Attain knowledge on the various schemes of conventional and nonconventional power generation.**(K2)**
CO2 - Have knowledge on the topologies and energy sources of distributed generation.**(K2)**
CO3 - Learn about the requirements for Microgrid interconnection and its impact. **(K2)**
CO4 - Familiarize with the techniques of control and operation of microgrid.**(K2)**
CO5 - Comprehend the standards and regulations of distributed generation, microgrid and grid integration. **(K2)**

UNIT I INTRODUCTION (9 Hrs)

Distributed generation - overview and technology trends. Working principle, architecture and application of renewable based DG technologies - Non-conventional technology based DGs.

UNIT II DISTRIBUTED GENERATIONS (9 Hrs)

Concept of distributed generations-topologies-selection of sources- regulatory standards/framework- Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes-security issues in DG implementations - Energy storage elements: Batteries- ultra-capacitors- flywheels-Captive power plants

UNIT III MICROGRID AND IMPACT OF GRID INTEGRATION (9 Hrs)

Concept and definition -microgrid drivers and benefits- review of sources of microgrids- typical structure and configuration - AC and DC microgrids- Power Electronics interfaces - Requirements for grid interconnection, limits on operational parameters: voltage, frequency- THD- islanding issues- Impact of grid integration with NCE sources on existing power system: reliability-stability.

UNIT IV OPERATION AND CONTROL OF MICROGRID (9 Hrs)

Modes of operation and control of microgrid: grid connected and islanded mode- Active and reactive power control- protection issues, anti-islanding schemes - microgrid communication infrastructure - regulatory standards- Microgrid economics- Introduction to smart microgrids

UNIT V POWER QUALITY ISSUES (9 Hrs)

Introduction, Power quality disturbances -Transients, Voltage sags and swells, Over-voltages and under-voltages, Outage, Harmonic distortion, Voltage notching, Flicker, Electrical noise. Power quality sensitive customers, power quality improvement technologies.

Text Books

1. Nick Jenkins, JanakaEkanayake, GoranStrbac, “Distributed Generation”, Institution of Engineering and Technology, London, UK, 2010.
2. S. Chowdhury, S.P. Chowdhury and P. Crossley, “Microgrids and Active Distribution Networks”, The Institution of Engineering and Technology, London, United Kingdom, 2009.
3. Math H. Bollen, Fainan Hassan, “Integration of Distributed Generation in the Power System”, John Wiley & Sons, New Jersey, 2011.

Reference Books

1. DorinNeacsu, “Power Switching Converters: Medium and High Power”, CRC Press, Taylor & Francis, 2006.
2. Godfrey Boyle, “Renewable Energy-Power for a sustainable future”, Oxford University Press, 3rd Edition, 2013.
3. Nikos Hatziargyriou, “Microgrids: Architectures and Control”, Wiley-IEEE Press, 2013

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE717 / U19EEE65	ADVANCED CONTROL SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To outline the concept of state space analysis and to design the state controller and observers.
- To analyze the stability of non-linear systems.
- To analyze the system behavior and Lyapounov's method for stability.
- To analyze z-transform Spectrum analysis of sampling process.
- To analyze the stability of time-invariant, discrete-time control systems.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design state controllers and state observers.**(K3)**

CO2 - Analyze thebehavior of nonlinear system by phase plane method.**(K3)**

CO3- Analyze the Stability of the system using Lyapounov's method.**(K4)**

CO4 - Analyze the discrete system using Z-transform. **(K4)**

CO5-Design the digital filters.**(K4)**

UNIT I STATE VARIABLE DESIGN (9 Hrs)

Introduction- concepts of state variables and state model - Effect of state feedback - Pole placement design - Necessary and sufficient condition for arbitrary pole placement-State regulator design - Design of state observers Separation principle- State feedback with integral control-State space controller for DC motor with feedback control.

UNIT II NON-LINEAR SYSTEMS - I (9 Hrs)

Introduction - nonlinearities - Phase plane method: concepts, singular points, stability of nonlinear systems - Construction of phase trajectories system analysis by phase plane method - Describing function method.

UNIT III NON-LINEAR SYSTEMS - II(9 Hrs)

Stability analysis by describing function method - Jump resonance - Lyapounov's method for stability study, concept of Limit Cycle. Nonlinear modeling and identification of a DC motor

UNIT IV SAMPLED DATA ANALYSIS - I (9 Hrs)

Introduction - Spectrum analysis of sampling process signal reconstruction difference equations - Z transform function, Inverse Z transform function - Response of Linear discrete system - Z transform analysis of sampled data control systems.

UNIT V SAMPLED DATA ANALYSIS - II (9 Hrs)

Response between sampling instants - Z and S domain relationship - Pulse transfer function-State equation - Stability analysis – Jury's Test and compensation techniques - Digital filter design techniques.

Text Books

1. M. Gopal, "Digital Control and State Variable Methods", McGraw Hill India, 4th Edition, 2012.
2. K. Ogata, "Modern Control Engineering", Pearson, 5th Edition, 2014.
3. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2nd Edition, 2016.
4. Benjamine C. Kuo, "Digital Control Systems", Oxford University Press, 2nd Edition, 1995.
5. B. N. Sarkar, "Advanced Control Systems" PHI Learning Pvt. Ltd., 2013

Reference Books

1. M. Gopal, Modern Control System Theory, New Age International Publishers, 3rd Edition, 2014.
2. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Taylor and Franci Group, 2nd Edition, 2017.
3. AshishTewari, "Modern Control Design with MATLAB and SIMULINK", John Wiley, New Delhi, 1st Edition 2002.
4. T. Glad and L. Ljung, "Control Theory–Multivariable and Non-Linear Methods", Taylor and Francis, 1st Edition, 2009.
5. D. S. Naidu, "Optimal Control Systems", CRC Press, 1st Edition, 2002.

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5. https://www.tutorialspoint.com/ control systems steady state errors.html
6. https://www.mathworks.com/ optimal-and-robust-control-.html
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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE718 / U19EEE73	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To discover the importance of renewable energy power generation.
- To learn the various operating modes of solar and wind energy systems.
- To understand the different power converters for renewable energy systems.
- To gain knowledge on stand-alone and grid connected renewable energy systems.
- To acquire the importance of hybrid renewable systems and maximum power point tracking algorithms.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Design and analyze electrical generators for renewable energy conversion.**(K2)**

CO2 - Interpret the applications of power electronics in wind and solar energy systems. **(K2)**

CO3 - Design the different power converters for renewable energy systems. **(K2)**

CO4 - Analyze standalone and grid connected operating modes of wind, solar energy systems. **(K2)**

CO5 - Implement the maximum power point tracking algorithm and gain knowledge on hybrid systems. **(K2)**

UNIT I ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION (9Hrs)

Environmental aspects of electric energy conversion – impacts of renewable energy generation on environment – qualitative study of different renewable energy resources – Modeling and analysis of Induction Generator – Permanent Magnet Synchronous Generator – Squirrel Cage Induction Generator – Doubly Fed Induction Generator

UNIT II SOLAR ENERGY AND WIND ENERGY (9Hrs)

Solar energy: solar thermal conversion devices and storage – solar cells – characteristics and photovoltaic conversion – estimation of solar radiation – PV systems – analysis of PV systems – applications of PV Systems.

Wind Energy: nature of wind – site selection consideration – basic components of wind energy conversion system – types of wind machines – control techniques – applications of wind energy – inter connected systems

UNIT III POWER CONVERTERS (9 Hrs)

Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters-selection of inverter, battery sizing, array sizing.

Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS (9 Hrs)

Stand-alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS (9Hrs)

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking

Text Books

1. S. N. Bhadra, D.Kastha, S.Banerjee, “Wind Electrical Systems”, Oxford University Press, 1st Edition, 2005.
2. B. H. Khan, “Non-conventional Energy sources”, Tata McGraw-hill Publishing Company, 3rd Edition, 2017.
3. K. Venkataratnam, “Special Electrical Machines”, Universities Press, 1st Edition, 2008.

Reference Books

1. M. H. Rashid, “Power Electronics Hand book”, Academic press, 4th Edition, 2017.
2. Ion Boldea, “Variable speed generators”, Taylor and Francis group, 2nd Edition, 2015.
3. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, “Grid Converters for Photovoltaic and Wind Power Systems”, John Wiley and Sons, Ltd., 1st Edition, 2011.
4. Gray, L. Johnson, “Wind energy system”, Prentice hall linc, Electronic Edition, 2006.
5. Andrzej M. Trzynnadlowski, “Introduction to Modern Power Electronics”, Wiley, India Pvt. Ltd, 2nd Edition, 2012.

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3. https://www.irjet.net/archives/V5/i5/IRJET-V5I5482.pdf
4. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4778368
5. https://www.youtube.com/watch?v=GnZFi9CzF9Q

COs/POs/PSOs Mapping

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2	3	3	3	3	–	–	–	–	–	–	–	–	3	3	3
3	3	3	3	3	–	–	–	–	–	–	–	–	3	3	3
4	3	3	3	3	–	–	–	–	–	–	–	–	3	3	3
5	3	3	3	3	–	–	–	–	–	–	–	–	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE719 / U19EEE74	POWER SYSTEM OPERATION AND CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn about different types of load, load and security aspects of the power system.
- To understand the real power-frequency relationship and the mathematical model of Load Frequency Control Loop for single area systems.
- To familiarize with reactive power-voltage relationship and the necessity of voltage compensation in power system operation and control.
- To introduce the power system optimization problems such as unit commitment.
- To have an overview of economic load dispatch for power generation planning and control.

Course Outcomes

After completion of the course, students will be able to

CO1- Analyze the performance and security aspects of power system under various load conditions.**(K2)**
CO2-Construct the state variable model of frequency control loop in isolated and grid connected system.**(K3)**
CO3-Analyze the transfer function model of excitation system and classify the system level control schemes. **(K4)**
CO4-Forecast the load and gain knowledge on the constraints of unit commitment. **(K3)**
CO5 - Analyze the Economic load dispatch equations without loss and with loss. **(K4)**

UNIT I INTRODUCTION (9 Hrs)

Structure of power system – National and Regional load dispatching centers, Power scenario in Indian grid – Load curves – Load duration curve – Important terms and factors - Power system security – Factors affecting system security – Operating states of power system, P-f and Q-V loops – Need for voltage and frequency regulation in power system - Energy control center Functions.

UNIT II REAL POWER CONTROL (9 Hrs)

Fundamentals of speed governing mechanism and modeling – Speed-load characteristics – Load sharing between two synchronous machines in parallel, Concept of control area – LFC control of a single area system: Static and dynamic analysis of uncontrolled and controlled cases – Introduction to Multi-area systems

UNIT III REACTIVE POWER CONTROL (9 Hrs)

Reactive power control – Generation and absorption of reactive power – Typical excitation system – Modeling – Static and dynamic analysis – Stability compensation – Generation and absorption of reactive power, Methods of voltage control: shunt reactors – Shunt capacitors – Series Capacitors – Synchronous condensers – Static VAR systems – Tap-changing transformer

UNIT IV LOAD FORECASTING ANDUNIT COMMITMENT (9 Hrs)

Load forecasting – Components of system load – Forecasting of the base load by method of least square fit - Unit Commitment – Constraints: spinning reserve – Thermal unit constraints – Hydro constraints – Fuel constraints and other constraints – methods.

UNIT V ECONOMIC DISPATCH (9 Hrs)

Economic dispatch: Incremental cost curve – Co-ordination equations without loss and with loss – Solution by λ-iteration method – Base point and participation factors – Economic dispatch controller added to LFC.

Text Books

1. Olle I. Elgerad, “Electric Energy System Theory and Introduction”, Tata McGraw Hill, 2nd Edition, 2004.
2. Allen J. Wood, Bruce F. Wollen berg, “Power Generation, operation and control”, John Wiley and sons, 2nd Edition, 2008.
3. AbhijitChakrabarti and SunitaHalder, “Power System Analysis Operation and Control”, PHI learning Pvt. Ltd., 3rd Edition, 2010.

Reference Books

1. D. P. Kothar and I. J. Nagrath, “Modern Power System Analysis”, Tata McGraw Hill, 4th Edition, 2011.
2. PrabhaKundur, “Power System Stability and Control”, Tata McGraw Hill, 5th Edition, 2014.
3. A. K. Mahalanbias, D. P. Kothari and S. I. Ahson, “Computer Aided Power System Analysis and Control”, Tata McGraw Hill, 1990.
4. P.S.R. Murty, “Operation and Control in Power Systems”, BS Publications, 2nd Edition, 2011.
5. Carson. W. Taylor, “Power System Voltage Stability”, Taylor-McGraw Hill, 2000.

Web References

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3. https://nptel.ac.in/courses/108/105/108105067/
4. https://nptel.ac.in/courses/108/107/108107028/
5. https://nptel.ac.in/courses/108/107/108107127/
6. http://www.iitk.ac.in/npsc/Papers/NPSC2016/1570293957.pdf
7. https://www.power-technology.com/features/featurethe-10-worst-blackouts-in-the-last-50-years-4486990/

COs/POs/PSOs Mapping

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2	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
5	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE720 / U19EEE63	SPECIAL ELECTRICAL MACHINES	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the construction, operating modes and characteristics of stepper motors.
- To learn about the construction, principle of operation and characteristics of synchronous reluctance motors.
- To get familiar with construction, characteristics and various controllers for switched reluctance motors.
- To equip the students on the construction, principle of operation and characteristics of brushless D.C. motor.
- To learn the construction, characteristics and different controllers for permanent magnet synchronous motors.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Analyze the performance characteristics of stepper motors in various operating modes.**(K4)**

CO2 - Examine performance characteristics of synchronous reluctance motors and select appropriate controllers for any industrial applications. **(K4)**

CO3 - Compare the performance characteristics of different types of controllers used in switched reluctance motors. **(K4)**

CO4 - Interpret the performance of permanent magnet brushless D.C. motor.**(K4)**

CO5 - Analyze the performance characteristics of permanent magnet synchronous motors and to analyze the vector control schemes. **(K4)**

UNIT I STEPPER MOTORS (9 Hrs)

Constructional features and principle of operation: Variable reluctance, Permanent and Hybrid Stepper motor - Torque production in Variable Reluctance (VR) stepper motor– Static and Dynamic Characteristics – Microprocessor based control of stepper motors – Closed loop control – Applications.

UNIT II SYNCHRONOUS RELUCTANCE MOTORS (9 Hrs)

Constructional features of axial and radial air gap Motors - operating principle – Phasor diagram - Derivation of reluctance torque from phasor diagram- motor characteristics – Controller for Synchronous Reluctance motor - Vernier motor – Applications.

UNIT III SWITCHED RELUCTANCE MOTORS (9 Hrs)

Constructional features - principle of operation - Torque equation - Torque Speed Characteristics – Converters for SRM – Current control schemes: Hysteresis and PWM – Microprocessor based controller and Sensorless Controller - Closed loop control of SRM – Applications.

UNIT IV BRUSHLESS DC MOTORS (9 Hrs)

Construction and Principle of operation - Torque and EMF equation - Torque-Speed characteristics - Permanent Magnet materials - electronic commutator - Difference between mechanical and electronic Commutator – Rotor Position sensors: Hall effect sensors – Optical sensor - Microprocessor based controller - Sensorless control – Applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (9 Hrs)

Construction – Principle of operation – EMF and Torque equations - Phasor diagram – Torque-speed characteristics – Self-control– Vector control schemes - Microprocessor based control – Comparison of BLDC and PMSM – Applications.

Text Books

1. E.G.Janardanan, “Special electrical machines”, PHI learning Pvt. Ltd ,2nd Edition, 2014
2. T. J. E. Miller, “Brushless permanent magnet and reluctance motor drives”, Clarendon Press, Oxford, 2nd Edition, 1993.
3. K. Venkataratnam, “Special Electrical Machines”, Universities Press Private Limited, 1st Edition, 2009.

Reference Books

1. P. P. Acarnely, “Stepping Motors – A Guide to Motor Theory and Practice”, Peter Perengrinus, London, IFT Publishers, 4th Edition, 2007.
2. R. Srinivasan, “Special Electrical Machines”, Lakshmi Publications, 2013.
3. T. Kenjo and S. Nagamori, “Permanent Magnet and brushless DC motors”, Clarendon Press, Oxford, 1989.
4. J. Gnanavadivel, J. Karthikeyan and S. Albert Alexander, “Special Electrical Machines”, Anuradha publications, 3rd Edition, 2009.

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2. http://ess.inflibnet.ac.in.
3. https://nptel.ac.in/courses/108/102/108102156.
4. http://www.electrical4u.com.
5. https://vidwan.inflibnet.ac.in.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	-	-	-	-	-	-	-	1	1	2	1
2	3	3	2	3	-	-	-	-	-	-	-	1	2	1	1
3	3	2	2	3	-	-	-	-	-	-	-	1	3	3	3
4	2	3	3	2	-	-	-	-	-	-	-	1	3	2	3
5	3	2	3	2	-	-	-	-	-	-	-	1	2	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE821 / U19EEE80	POWER SYSTEM ECONOMICS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To Gain knowledge on characteristics operation of power plants and electrical tariff of the power system.
- To solve cost and loss calculation for optimum economy.
- To determine and explainthe economic scheduling of operation of thermal and hydro thermal stations.
- To acquire knowledge on analyzing, synthesizing various constraints methods.
- To estimate and analysis generation system reliability.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Compute the structure of electrical tariff and the impact of depreciation on the power components. **(K2)**
CO2 - Develop awareness of the technical problems associated with operation of such systems. **(K4)**
CO3 - Analyze Thermal and Hydro generator characteristics and their economic operation. **(K4)**
CO4 - Solve the Unit Commitment problem with various constraints using conventional optimization techniques. **(K3)**
CO5 - Comprehend the importance of maintaining reliability of power system components. **(K3)**

UNIT I ECONOMIC CONSIDERATIONS (9 Hrs)

Cost of electrical energy - Expressions for cost of electrical energy – Capital-interest – Depreciation - Different methods - Factors affecting cost of operation - Number and size of generating units - Importance of high load factor - Importance of power factor improvement - Most economical power factor - Meeting the KW demand on power stations - Power system tariffs -Regions and structure of Indian Power System - Regulatory and Policy development in Indian power Sector.

UNIT II ECONOMIC DISPATCH (9 Hrs)

Modeling of Cost Rate Curves – Economic Dispatch Calculation - Losses neglected, with generator Real and Reactive power limits; Losses included - Losses of economy in incremental cost data - General loss formula-Participation Factor-Problems - Generator Capability Curve – Effect of Ramping rates – Prohibited Operating Zones - Automatic Load dispatch in Power Systems.

UNIT III INTERCONNECTED SYSTEMS (9 Hrs)

Interconnected operation - Economic operation of hydro thermal power plants - Iteration scheme - Gradient approach – Newton's method - Modeling and solution approach to short term and long term Hydro-Thermal scheduling problem using Dynamic Programming.

UNIT IV OPTIMAL POWER FLOW (9 Hrs)

Problem formulation - Cost minimization - Loss minimization - Solution using NLP and successive LP methods – Constraints - DC and AC OPF (Real and Reactive Power Dispatch) – Effect of Contingencies - Voltage and Phase angle - Transient Voltage Dip/Sag Criteria.

UNIT V FUNDAMENTALS OF MARKETS (9 Hrs)

Fundamentals of Markets – Introduction to Efficiency and Equilibrium - Modeling of consumers and producers – Single and Double Auction mechanism - Global welfare – Dead Loss – Spot and Forward Markets- carbon credit.

Text Books

1. Allen J Wood and BF Wollen berg, "Power Generation, Operation and Control", John Wiley and Sons, New York, 1st Edition, 2013.
2. Steven Stoft, "Power System Economics", John Wiley and Sons, 1st Edition, 2002.
3. V.K.Metha and RohitMetha, "Principles of Power System", S. Chand, 4th Edition, 2008.

Reference Books

1. Daniel S .Kirschen and GoranStrbac, "Power System Economics", John Wiley and Sons Ltd, 2nd Edition, 2018.
2. HadiSaadat, "Power System Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st Reprint Edition, 2010.
3. Fereidoon P. Sioshansi and Wolfgang Pfaffenberger, "Electricity Market Reform", Elsevier Science Ltd, 1st Edition, 2006.

4. Xiao-Ping Zhang, “Restructured Electric Power Systems: Analysis of Electricity Markets with Equilibrium Models”, John Wiley and Sons, 1st Edition, 2010.
5. M. A. Pai, “Computer Techniques in Power System Analysis”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2012.

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4. https://www.classcentral.com/course/swayam-computer-aided-power-system-analysis-12954
5. https://www.powermin.nic.in
6. https://www.posoco.in
7. http://www.ijerd.com/paper/Conference/Version-2/E3645.pdf
8. http://ijoer.com/Paper-January-2016/IJOER-JAN-2016-4.pdf

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4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	1	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE81	MODERN POWER ELECTRONIC CONVERTERS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To acquire knowledge on the design of various types of switched mode power supplies and its control techniques.
- To impart the knowledge on working principle of high frequency switching ac – dc converters.
- To understand the characteristics and principle of operation of various types of dc – ac, ac – ac converter and techniques to reduce the harmonics.
- To explain about the matrix and AC- AC converter with and without DC link and to understand the difference between the converters.
- To learn the different soft switching technique available for power converters in order to reduce switching losses and increase converter efficiency

Course Outcomes

After completion of the course, the students will be able to

CO1 - Select and design appropriate switched mode regulated power supply for various applications. **(K3)**
CO2 - Design and analyze the operating principle of AC – DC converters and their performance**. (K3)**
CO3 - Develop analysis skills on several important topologies of Inverter circuits**. (K4)**
CO4 - Understand the operating issues of matrix converter, AC – AC converters and its importance. **(K3)**
CO5 - Design and apply appropriate soft switching technique for various power converter such as AC-DC, DC-AC and AC-AC**. (K3)**

UNIT I SWITCHED MODE POWER SUPPLIES (9 Hrs)

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS (9 Hrs)

Switched mode AC-DC converters - synchronous rectification - single and three phase topologies - switching techniques - high input power factor - reduced input current harmonic distortion - improved efficiency - with and without input-output isolation - performance indices design examples

UNIT III DC-AC CONVERTERS (9 Hrs)

Multi-level Inversion: concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters - Modulation schemes.

UNIT IV AC- AC CONVERTERS WITH AND WITHOUT DC LINK (9 Hrs)

Matrix converters: Basic topology - Commutation – current path. Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT-SWITCHING POWER CONVERTERS (9 Hrs)

Soft switching techniques - ZVS, ZCS, quasi resonance operation - Performance comparison - hard switched and soft switched converters - AC-DC converter, DC-DC converter, DC-AC converter - Resonant DC power supplies.

Text Books

1. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education, New Delhi, 4th Edition, 2017.
2. Fang Lin Luo and Fang Lin Luo, “Advanced DC/DC Converters”, CRC Press, New York, 1st Edition, 2013.
3. Andrzej M. Trzynadlowski, “Introduction to Modern Power Electronics”, Wiley Publication, 3rd Edition, 2016.
4. Simon Ang, Alejandro Oliva, “Power-Switching Converters”, CRC Press, 3rd Edition, 2010.

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1. FredeBlaabjerg and Zhe Chen, “Power Electronics for Modern Wind Turbines”, Morgan & Claypool Publishers series, United States of America, 1st Edition, 2006.
2. Jai P. Agarwal, “Power Electronics: Converters, Applications, and Design”, Prentice Hall, 3rd Edition, 2000.
3. M. D. Singh and K. B Khachandani, “Power Electronics”, McGraw-Hill Education, 2nd Edition, 2017.

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4. https://www.tutorialspoint.com/power_electronics/power_electronics_matrix_converters.htm
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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
2	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
3	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
4	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
5	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE822 **FACTS**

L	T	P	C	Hrs
3	0	0	3	45

Course objectives

- To comprehend fundamentals of FACTS Controllers and its various considerations.
- To equip the students to understand the voltage control of SVC and enhancement of stability.
- To impart knowledge on different modes of operation of TCSC and its performance characteristics.
- To equip the students to understand the operation and control of voltage source converter based FACTS controllers
- To study the different emerging FACTS controller for transmission systems

Course outcomes

After completion of the course, the students will be able to

CO1 - Analysethe problems in AC transmission systems and understand the need for Flexible AC transmission systems. **(K2)**

CO2 - Analyse the voltage control of SVC and its applications to enhance the stability and damping.**(K3)**

CO3 - Analyse the performance characteristics of TCSC and to model it for power flow and stability studies. **(K3)**

CO4 - Analyse the operation and control of voltage source converter based FACTS controllers.**(K3)**

CO5 - Analyze the different emerging FACTS controller for transmission systems and interaction between the FACTS controllers. **(K3)**

UNIT I INTRODUCTION (9Hrs)

Introduction to FACTS- Real and Reactive power control in electrical power transmission lines – loads & system compensation, Uncompensated transmission line – shunt and series compensation-Classifications.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS (9Hrs)

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage–Design of SVC voltage regulator – Modeling of SVC for power flow and fast transient stability– Applications: Enhancement of transient stability – Steady state power transfer –Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS (9Hrs)

Operation of the TCSC–Different modes of operation–Modeling of TCSC, Variable reactance model– Modeling for Power Flow and stability studies. Applications: Improvement of the system stability limit–Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS (9Hrs)

Static Synchronous Compensator (STATCOM)–Principle of operation– V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability-prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modeling of SSSC in load flow and transient stability studies.

UNIT V EMERGING FACTS CONTROLLERS (9Hrs)

Unified Power flow controller (UPFC) - Principles of operation and characteristics - Interline DVR (IDVR) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC); FACTS Controller interactions – SVC interaction – Co-ordination of multiple controllers using linear control techniques

Text Books

1. N.G.Hingorani and L.Guygi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, John Wiley and Sons, Inc., 1st Edition, 2011.
2. R. Mohan Mathur, Rajiv K. Varma, “Thyristor-Based FACTS Controllers for Electrical Transmission Systems”, IEEE press and John Wiley and Sons, Inc., 2nd Edition, 2002.
3. V. K.Sood, “HVDC and FACTS controllers - Applications of Static Converters in Power System”, Kluwer Academic Publishers, 2nd Edition, 2004

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1. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, “Flexible AC Transmission System: Modelling and Control”, Springer, 1st Edition, 2012.
2. K.R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International,1st Edition, 2013.

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2. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=00634216
3. https://nptel.ac.in/courses/108107114/
4. https://www.elprocus.com/flexible-ac-transmission-system-need-definition-types/
5. https://link.springer.com/book/10.1007%2F3-540-30607-2

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2	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE823 / U19EEE75	SMPS AND UPS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To provide conceptual knowledge of various types of DC – DC converters.
- To impart the knowledge on various types of switched mode power converters and its voltage control techniques
- To understand the importance of Zero voltage and Zero current switching used in resonant converters
- To analyze the PWM techniques and harmonic reduction techniques in DC – AC converters.
- To explain the various types of filters and techniques to improve the power quality.

Course Outcomes

After completion of the course, the students will be able to

CO1 –Design the DC-DC converters to find their stability. **(K2)**

CO2 - Analyze, design and select the converter used for switched mode power supplies in Computers, Laptop, and TV. **(K4)**

CO3 - Describe the importance of resonant Converters in reducing power loss and improving the life time of the power semiconductor device. **(K2)**

CO4 - Conclude the different voltage and harmonics reduction techniques used for DC-AC converters. **(K4)**

CO5 - Interpret knowledge on techniques to improve the power quality and design of filters for UPS. **(K2)**

UNIT I DC - DC CONVERTERS (9 Hrs)

Principles of DC-DC Converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters, Cascaded Boost Converters – two, three and higher stage – Negative output –Choice of switching frequency – Device Selection - EMI issues

UNIT II SWITCHED MODE POWER CONVERTERS (9 Hrs)

SMPS Types: Self-Oscillating Flyback, Forward, Push pull, Luo, Half bridge and fullbridge converters- control circuits and PWM techniques - SMPS with multiple outputs - Choice of switching frequency – Device Selection - State space modeling.

UNIT III RESONANT CONVERTERS (9 Hrs)

Introduction- classification - Load Resonant converters - ZVS, ZCS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control. Multi energy storage element resonant converters - two, three and four element RPS - Application of Regulated Power Supply.

UNIT IV DC – AC CONVERTERS (9 Hrs)

Single phase and three phase inverters - control techniques, harmonic elimination techniques - Multilevel inverters -Concepts - Types: Diode clamped, Flying capacitor, Cascaded types; Switched Inductor and Capacitor multilevel Inverter - Applications.

UNIT V POWER CONDITIONERS, UPS AND FILTERS (9 Hrs)

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of high frequency inductor and transformer – Selection of capacitor and Batteries

Text Books

1. Simon Ang, Alejandro Oliva, “Power-Switching Converters”, CRC Press, 3rd Edition, 2010.
2. KjeldThorborg, “Power Electronics – In theory and Practice”, Overseas Press India Private Ltd, 1st Edition, 2005.
3. M. H. Rashid, “Power Electronics handbook”, Elsevier Publication, 4th Edition, 2017.

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1. Philip T Krein, “Elements of Power Electronics”, Oxford University Press, 2nd Edition, 2014.
2. Erickson, W. Robert, “Fundamentals of Power Electronics”, Springer, 2nd Edition, 2010.
3. Joseph Vithayathil, “Power Electronics, Principles and Applications”, McGraw Hill Series, 6th Reprint, 2013.
4. Ned Ned Mohan, Tore M. Undeland, William P. Robbins,“Power Electronics: -Converters, Applications, and Design”, John Wiley and sons Publication, 3rd Edition, 2010.
5. Fang Lin Luo, “Advanced DC/AC converters: Applications in renewable Energy”, CRC press, 1st Edition, 2013.

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4. https://ndl.iitkgp.ac.in/
5. http://www.cpes.vt.edu/areas/
6. https://www.coursera.org/specializations/power-electronics

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3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE824 **OPTIMIZATION TECHNIQUES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To learn the fundamentals optimization Techniques and its evolution process.
- To acquire optimization techniques using both linear and non-linear programming
- To learn various optimization algorithm constrained
- To compute the Genetic Algorithm (GA) search methods.
- To study the concepts particle swam optimization

Course Outcomes

After completion of the course, the students will be able to

CO1 – Familiarize the optimization techniques analysis**.(K1)**
CO2 – Analyse efficient computational procedures to solve optimization problems **(K2)**
CO3 – Apply constrained optimization algorithm for evaluation process **(K2)**
CO4 – Evaluate various genetic algorithm operators for evaluation process.(**K2)**
CO5 – Comprehend the basic structure of PSO and various multi-objective optimization .**(K4)**

UNIT I INTRODUCTION(9 Hrs)

Introduction to optimization- historical development- statement of an optimization problem-classification of optimization problem- techniques- single variable optimization- multivariable optimization with equal constraints, Inequality constraints

UNIT II LINEAR AND NON-LINEAR PROGRAMMING (9 Hrs)

Linear programming problems: Definition- Standard form – geometry- simplex algorithm- decomposition principle- karmarkar's method- application.

Non-Linear programming: Elimination method- interpolation methods- classification of unconstrained minimization methods.

UNIT III CONSTRAINED OPTIMIZATION ALGORITHM(9 Hrs)

Characteristics of a constrained problem- Direct methods: complex method- Cutting plane method- Indirect method: Transformation Technique- Basic approach in the penalty function method-Interior penalty function method-convex method.

UNIT IV GENETIC ALGORITHM (9 Hrs)

Genetic algorithm–Representation of design variables- objective function and constraints- genetic operators- GA versus Traditional methods- steady state selection- selection schemes.

UNIT V PARTICLE SWAM OPTIMIZATION (9 Hrs)

Basic principle- algorithm- flowchart- computation implementation- improvement to PSO- solution of constrained optimization problem-Multi swam optimization- Multiobjective Optimization

Text Books

1. S.S. Rao, Engineering optimization: Theory andPractice, New age international (P) Ltd. 4th Edition, 2001
2. David E. Gold Berg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 1st Edition, 2008.
3. Parsopoulos, K.E., Vrahatis, M.N., Particle Swarm Optimization and Intelligence:Advances and Applications, Information Science Reference, IGI Global, 1st Edition, 2010

Reference Books

1. Kalyanmoy Deb, "Optimization for Engineering Design, algorithms and examples", PHI Publishers, 2nd Edition, 2012.
2. T. J. Ross, "Fuzzy Logic with Engineering Applications", Wiley, 3rd Edition, 2010.
3. Sivanandam, S.N., Deepa, S. N , "Introduction to Genetic Algorithms, Springer", 1st Edition , 2011.
4. EthemAlpydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)", MIT Press, 2nd Edition, 2010.

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3. https://www.semanticscholar.org/paper/Chapter-2-Soft-Computing-Techniques-and-Their Chaturvedi/6bc3d9f13d78b36dabeb06436a2b97bd32dbac50
4. https://ieeexplore.ieee.org/document/7938905
5. https://www.igi-global.com/chapter/soft-computing-its-applications/46389

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1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2
2	3	2	2	-	-	-	-	-	-	--	-	-	3	2	2
3	2	2	2	-	-	-	-	-	-	-	-	-	3	2	2
4	2	2	3	-	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	-	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U19EEE83 **SOFT COMPUTING TECHNIQUES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To gain knowledge on the basics of artificial neural network.
- To modelling and control of neural and fuzzy control schemes.
- To feature hybrid control schemes.
- To study about Fuzzy Logic, Various fuzzy systems and their functions
- To Understand different soft computing tools to solve real life problems

Course Outcomes

After completion of the course, the students will be able to

CO1 - Survey various neural network architectures. **(K3)**
CO2 - Get knowledge on modelling and control of neural. **(K2)**
CO3 - Define the fuzzy systems. **(K1)**
CO4 - Acquire knowledge on modelling and control of fuzzy control schemes. **(K2)**
CO5 - Express knowledge on hybrid control schemes. **(K2)**

UNIT I ARTIFICIAL NEURAL NETWORK (9 Hrs)

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

UNIT II NEURAL NETWORKS FOR MODELING AND CONTROL(9 Hrs)

Modelling of non-linear systems using ANN – Generation of training data – Optimal architecture– Model validation – Control of non-linear systems using ANN – Direct and indirect neuro control schemes – Adaptive neuro controller – Familiarization with neural network toolbox.

UNIT III FUZZY SET THEORY (9 Hrs)

Fuzzy set theory – Fuzzy sets – Operation on fuzzy sets – Scalar cardinality, fuzzy cardinality, union and intersection, complement (Yager and Sugeno), equilibrium points, aggregation, projection, composition, cylindrical extension, fuzzy relation – Fuzzy membership functions.

UNIT IV FUZZY LOGIC FOR MODELING AND CONTROL (9 Hrs)

Modelling of non-linear systems using fuzzy models – TSK model – Fuzzy logic controller – Fuzzification – Knowledge base – Decision making logic – Defuzzification – Adaptive fuzzy systems – Familiarization with fuzzy logic toolbox

UNIT V HYBRID CONTROL SCHEMES (9 Hrs)

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

Text Books

1. Laurence Fausett, “Fundamentals of Neural Networks”, Pearson Education India, 1st Edition, 2004.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 3rd Edition, 2011.

Reference Books

1. Goldberg, “Genetic Algorithm in Search, Optimization and Machine learning”,Addison Wesley Publishing Company Inc. 1989.
2. W. T. Millon, R. S. Sutton, P. J. Webrose, “Neural Networks for Control”, MIT press, 2nd Edition, 2010.
3. EthemAlpaydin, “Introduction to Machine learning (Adaptive Computation and Machine Learning series”’, MIT Press, 2nd Edition, 2010.
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4. https://ieeexplore.ieee.org/document/7938905
5. https://www.igi-global.com/chapter/soft-computing-its-applications/46389

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	3	2
2	3	2	2	-	-	-	-	-	-	--	-	-	3	3	2
3	3	2	2	-	-	-	-	-	-	-	-	-	3	3	2
4	3	2	3	-	-	-	-	-	-	-	-	-	3	3	2
5	3	2	3	-	-	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

U20EEE825 / U19EEE84	FUNDAMENTALS OF SOLAR PHOTOVOLTAIC SYSTEM AND APPLICATIONS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart fundamental knowledge of solar cell formation, its properties and manufacturing
- To understand the various components required in grid connected systems and its importance.
- To discuss the various components in standalone PV systems.
- To gain knowledge on various solar hybrid systems and their comparisons.
- To design the PV systems for various real load applications on cost economics.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the basic concepts of solar cells and its properties. **(K2)**

CO2 - Discuss about the selection of interfacing components in solar grid connected systems. **(K2)**

CO3 - Review about the various DC/AC equipment's used for stand-alone PV applications through requirements and design calculations. **(K2)**

CO4 - Analyze the typical applications of solar hybrid systems and define the structure of micro grid system.**(K3)**

CO5 - Compute cost benefit analysis of any solar PV systems. **(K3)**

UNIT I PHOTOVOLTAIC BASICS AND DEVELOPING TECHNOLOGIES (9Hrs)

Solar Cells: Structure and working - Types, Electrical properties - Cell properties and design - PV cell interconnection and Module fabrication - PV Modules and arrays. Commercial technologies: Mono crystalline and Multi crystalline, Silicon – Wafer based Solar cell, Thin film solar cells: A–Si, Cd–Te and CIGS, Concentrated PV cells, Developing technologies : Organic cells, Dye sensitized cells – Photovoltaic in global and Indian scenario

UNIT IISOLAR PV FOR ON-GRID APPLICATIONS (9Hrs)

Solar cells to solar array – On–Grid PV system – With and Without storage – Balance of system – DC–DC converters – Inverters – Net Metering – Design and analysis – Performance evaluation and monitoring

UNIT III SOLAR PV FOR OFF-GRID APPLICATIONS (9Hrs)

Off-Grid standalone PV system – System sizing – Module and Battery – Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One–axis, Two–axis – Maximum power point tracking – Design and analysis – Performance evaluation and monitoring

UNIT IV HYBRID SYSTEMS (9Hrs)

Solar, Biomass, Wind and Diesel Hybrid systems - Comparison and selection criteria - simple hybrid systems – storage arrangements - Introduction to Micro grid – Comparison of micro grid with conventional power system – Architecture

UNIT V COST BENEFIT ANALYSIS FOR SOLAR PV INSTALLATIONS (9Hrs)

Cost and manufacturability – Manufacturing economics – Scaling – Pricing – Trends in retail pricing – Energy economics – Grid tied power plant – Solar street lighting system - Simple payback calculation.

Text Books

1. C.S. Solanki, "Solar Photovotaics – Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2nd Edition, 2011.
2. Martin A. Green, "Solar Cells Operating Principles, Technology, and System Applications", Prentice - Hall, 1st Edition, 2008.

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1. J. Nelson, "The Physics of Solar Cells", Imperial College Press, 1st Edition, 2003.
2. Thomas Markvart, "Solar Electricity", John Wiley and Sons, 2nd Edition, 2000.
3. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish, "Applied Photovoltaics", Earth scan, 3rd Edition, 2011.
4. Michael Boxwell, "The Solar Electricity Handbook", Green stream Publishing, 10th Edition, 2016.
5. RikDe Gunther, "Solar Power-Your Home for Dummies", Wiley Publishing Inc, 2nd Edition, 2010.

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5. https://www.energysage.com/solar/
6. https://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf
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3	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
4	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
5	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE826 / U19EEE85	PRINCIPLES OF VIRTUAL INSTRUMENTATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To review background information required for studying virtual instrumentation.
- To study the basic building blocks of virtual instrumentation.
- To study the various techniques of interfacing of external instruments of PC.
- To study the various graphical programming environment in virtual instrumentation.
- To study a few applications in virtual instrumentation

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the concepts of virtual instruments. **(K2)**

CO2 - Apply the programming concepts using LabVIEW. **(K4)**

CO3 - Create simple measurement system using LabVIEW programs. **(K4)**

CO4 - Demonstrate the program in LabVIEW for system monitoring, processing and controlling operations **(K4)**

CO5 - Comply the basics of interfacing and programming using related hardware **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Virtual Instrumentation and LabVIEW - Evolution of LabVIEW - Difference between LabVIEW and conventional languages - Sequencing and data flow - Graphical programming.

UNIT II LABVIEW PROGRAMMING TECHNIQUES (9 Hrs)

Front panel - Block diagram - VIs - Sub-VIs - Simple examples - Looping: For loop, while loop - Shift registers - case and sequence; structures, formula nodes. Arrays - Clusters, charts and graphs - Local and global variables - Property node, string and file I/O. publishing measurement data in the web

UNIT III DATA ACQUISITION (9 Hrs)

DAQ – Components - Buffers - Triggering - Analog I/O - Digital I/O - Counters and timers - DMA, Software and hardware installation, Calibration, Resolution, Data acquisition interface requirements.

UNIT IV INSTRUMENT CONTROL (9 Hrs)

VI Chassis requirements. Common Instrument Interfaces: Current loop, RS 232C/ RS485, GPIB. Bus Interfaces: USB, PCMCIA, VXI, SCSI, PCI, PXI, compact RIO - Firewire. PXI system controllers, Ethernet control of PXI. Networking basics for office - Industrial applications, VISA and IVI.

UNIT V APPLICATION OF VIRTUAL INSTRUMENTATION (9 Hrs)

VI toolsets, Distributed I/O modules Instrument Control, Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control

Text Books

1. Sanjay Gupta, Joseph John, “Virtual Instrumentation using LabVIEW”, Tata McGraw-Hill, 2nd Edition, 2010.
2. Jovitha Jerome, “Virtual Instrumentation Using LabVIEW”, PHI Learning, 1st Edition, 2010.

Reference Books

1. Lisa K Wells, Jeffrey Travels, “LabVIEW for everyone”, Prentice Hall, 3rd Edition, 2009.
2. S. Gupta, J.P. Gupta, “PC interfacing for data acquisition and process control”, Instrument Society of America, 2nd Edition, 1994.
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3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE827 / U19EEE86	EHV AC AND DC TRANSMISSION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To impart knowledge on structure of power system and standard voltage levels
- To study the transmission line and ground parameters
- To equip the students to understand the HVDC transmission system and its types.
- To impart knowledge on various FACTS devices on power system
- To understand the electrostatic and magnetic fields of EHV lines

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identify the transmission (HVAC and HVDC) and distribution voltage levels. **(K2)**

CO2 - Compute and extract the transmission line parameters. **(K3)**

CO3 - Analyze and locate required HVDC transmission in power system. **(K3)**

CO4 - Analyze the performance characteristics of FACTS devices and select suitable FACTS devices for various applications.**(K3)**

CO5 - Compute electrostatic and magnetic fields of EHV lines. **(K3)**

UNIT I TRANSMISSION LINE TRENDS (9 Hrs)

Standard transmission voltages, average values of line parameters, Substation equipments – Power handling capacity and line losses - number of lines, Advantages and disadvantages of HVAC and HVDC system.

UNIT II LINE AND GROUND PARAMETERS (9 Hrs)

Resistance, Temperature rise and current carrying capacity of conductors. Properties of Bundle conductors – Calculation of L and C parameters – Modes of propagation – Effect of Earth.

UNIT III HVDC SYSTEM (9 Hrs)

Economics and Terminal equipment of HVDC transmission systems – HVDC Power transmission–Description, principles of operation and Planning for HVDC transmission–DC breakers–Operating problems– HVDC transmission based on VSC –Types and applications of MTDC systems.

UNIT IV FACTS (9 Hrs)

Basic concepts – Real and Reactive power control, uncompensated transmission line, series compensation, SVC, thyristor control, series capacitor, static synchronous compensator, unified power flow controller and applications.

UNIT V ELECTROSTATIC AND MAGNETIC FIELDS OF EHV LINES (9 Hrs)

Electric shock – threshold currents – Calculation of electrostatic fields and magnetic fields of AC and DC lines – Effect of fields on living organism – Electrical field measurement.

Text Books

1. K. R. Padiyar, “HVDC power transmission system”, Wiley Eastern Limited, 3rd Edition, 2014.
2. Rakosh Das Begamudre , “Extra High Voltage AC Transmission Engineering”, New Academic Science, 4th Edition, 2011
3. P. Kundur, “Power System stability and control”, Tata McgrawHilll Publishers, 1st Edition, 2006.

Reference Books

1. DraganJovcic, “High Voltage Direct Current Transmission: Converters, Systems and DC Grids”, Wiley Publishers, 2nd Edition, 2019.
2. N.G.Hingorani and L.Guygi, “Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems”, John Wiley and Sons, Inc., 1st Edition, 2011.
3. S. Rao, “EHV-AC, HVDC Transmission and Distribution”, Khanna Publishers, 3rd Edition, 2009.
4. Jos Arrillaga, “High Voltage Direct Current Transmission”, Institution of Engineering and Technology, 2nd Edition, 2008.

Web References

1. http://nptel.ac.in/courses/108104013
2. https://nptel.ac.in/courses/108/102/108102047/
3. https://electrical-engineering-portal.com/advantages-of-hvdc-over-hvac-transmission
4. https://electrical-engineering-portal.com/why-hvdc-transmission-system-beats-hvac
5. https://www.youtube.com/watch?v=cEKB4jvW5Mg

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
2	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
3	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
4	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2
5	3	3	3	3	-	-	-	-	-	-	-	-	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE828 / U19EEE87	RESTRUCTURED POWER SYSTEM	L	T	P	C	Hrs
		3	0	0	3	45

Course objectives

- To provide in-depth understanding of operation of restructured electricity market.
- To explain topical issues in transmission challenges and computation of available transfer capability.
- To explore electricity market operational and control issues under congestion management.
- To comprehend different pricing mechanism of electric energy and trading of power under restructured environment.
- To describe the current scenario and operation issues in restructured Indian power market.

Course outcomes

After completion of the course, the students will be able to

CO1 - Illustrate the needs for restructuring power systems and generalize the activities of Independent system operator. **(K2)**

CO2 - Identify the transmission challenges using various methodology and estimate available transfer Capability. **(K3)**

CO3 - Analyze transmission open access pricing issues in congestion management and ancillary service methods in restructured environment. **(K2)**

CO4 - Calculate transmission pricing for reliable operation of the electricity market. **(K3)**

CO5 -Interpret about available based tariff and open access issues in restructured Indian power market. **(K2)**

UNIT I FUNDAMENTALS OF POWER MARKETS (9 Hrs)

Fundamentals of Restructured Power system – Motivation for restructuring –Components of Restructured Systems: Gencos, Discos and Retailers, Wheeling Methodology - Power exchange and market operations - Framework and methods for the analysis of Bilateral and pool markets - Role of Independent System Operator - Operating Experiences of Restructured Electricity Markets in various Countries - Restructuring process in Indian Electric Power Market.

UNIT II TRANSMISSION CHALLENGES (9 Hrs)

Role of transmission planning– Transmission Capacity – Total Transfer Capability – Computational procedure - Margins– Concept of Available transfer capability – Principles – Constraints - Market splitting- counter - trading - Methodology to compute ATC - Calculation of ATC using AC model - Price based OPF in restructured markets.

UNIT III CONGESTION MANAGEMENT AND ANCILLARY SERVICES (9 Hrs)

Concept of Congestion Management – Methods to relieve the congestion - Inter and Intra zonal Congestion Management – Locational Marginal Pricing – Price area congestion management - Congestion Management in Open - access Transmission Systems - Financial Transmission Right - Ancillary Services - Synchronous Generators as Ancillary Service Providers - Voltage control and reactive power support ancillary services.

UNIT IV TRANSMISSION PRICING (9 Hrs)

Transmission pricing methods - Postage stamp - Contract path - MW-mile methods – Distribution Factor method – Congestion Pricing, Tracing method- Comparison between various methods - Short run marginal cost – Generator Ramping and Opportunity Costs - Marginal cost of generation - least cost operation-incremental cost of generation - Challenges to electricity pricing - ANN based price forecasting.

UNIT V INDIAN POWER MARKET(9 Hrs)

Current Scenario – Regions – Regulatory and Policy development in Indian power Sector – Availability based tariff – Necessity – Working Mechanism – Unscheduled Interchange Rate – Operation of Indian Power Exchange - Attributes of a perfectly competitive market - Opportunities for IPP and capacity power producer - Indian Electricity Grid Code - Open access issues – Power exchange – Reforms in the near future.

Text books

1. LoiLeiLai, “Power system Restructuring and Regulation”, John Wiley sons, 1st Edition, 2001.
2. Kankar Bhattacharya, Math H. J. Bollen and Jaap E. Daalder, “Operation of Restructured Power Systems”, Kluwer Academic Publishers, 1st Edition, 2001.
3. M. Shahidehpour, H. Yamin and Z. Li, “Market Operations in Electric Power Systems”, John Wiley and Sons, Inc., 1st Edition, 2002.

Reference books

1. M. M. Tripathi. “Restructured Power System and Electricity Market” Createspace Independent Pub., 1st Edition, 2015.
2. M.Shahidehpour and M.Alomoush, “Restructuring Electrical Power Systems”, CRC Press, 1st Edition, 2017.
3. Dr. Rajib Mishra, V. K. Khanija and P. P. Wahi, “Indian Power Market (Electricity Marketing Simplified)” Central Board of Irrigation and Power (CBIP), Govt of India, 2016.

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1. https://greeningthegrid.org/integration-in-depth/ancillary-services
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3. https://nptel.ac.in/courses/108/101/108101005/
4. https://www.sterlitepower.com/blog/overcoming-transmission-challenges-technology
5. https://ocw.mit.edu/courses/institute-for-data-systems-and-society/ids-505j-engineering-economics-and-regulation-of-the-electric-power-sector-spring-2010/lecture-notes/MITESD_934S10_lec_16.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
3	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
4	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1
5	3	3	3	2	-	-	-	-	-	-	-	1	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE829 / U19EEE88	POWER SYSTEM STABILITY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the fundamental concepts of stability of power systems and its classification
- To expose the students to dynamic behavior of the power system for small and large disturbances
- To gain knowledge on various numerical integration methods
- To comprehend the factors affecting voltage stability and voltage collapse
- To provide knowledge about the methods of improving stability

Course Outcomes

After completion of the course, the students will be able to

CO1 – Analyze power system stability problems occurring in power grid **(K2)**
CO2 – Perform small signal stability analysis of single machine infinite bus system **(K3)**
CO3 – Interface synchronous machine model to transient stability algorithm **(K3)**
CO4 – Elucidate the factors affecting voltage stability and its characteristics on power system components **(K2)**
CO5 – Analyze various methods to enhance transient stability and small-signal stability **(K2)**

UNIT I INTRODUCTION (9 Hrs)

Concept and importance of stability to power system: Steady state, transient and dynamic stability - single equivalent machine connected to infinite bus - multi machine stability problem - Swing equation for a synchronous Machine – Modelling of Synchronous machine for stability studies(classical model) - Rotor dynamics and the swing equation.

UNIT II SMALL-SIGNAL STABILITY (9 Hrs)

Fundamental concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape, sensitivity and participation factor. Small–signal stability analysis of a Single-Machine Infinite Bus.

UNIT III TRANSIENT STABILITY (9 Hrs)

Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability. Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm.

UNIT IV VOLTAGE STABILITY (9 Hrs)

Factors affecting voltage stability- Classification of Voltage stability-Transmission system -Generator - Load characteristics- Reactive power compensating Devices- Voltage collapse, Prevention of voltage collapse.

UNIT V METHODS OF IMPROVING STABILITY (9 Hrs)

Transient stability enhancement: High-speed fault clearing regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems. Small signal stability enhancement: Power system stabilizers, supplementary control of static var compensator and HVDC transmission links.

Text Books

1. PrabhaKundur, “Power System Stability and Control”, McGraw Hill Education, 1st Edition, 2006.
2. K R Padiyar, “Power System Dynamics: Stability and Control”, BS Publications, 2nd Edition, 2008.
3. Vijay Vittal, James D. McCalley, Paul M. Anderson, “Power System Control and Stability”, Wiley-Blackwell, 3rd Edition, 2019.

Reference Books

1. R.Ramnujam,” Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 1st Edition, 2009.
2. Peter W., Saucer, Pai M.A., “Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
3. EW. Kimbark, “Power System Stability”, John Wiley & Sons Limited, New Jersey, 1st Edition, 2013.

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3. https://nptel.ac.in/content/storage2/courses/108106026/chapter1.pdf
4. https://electrical-engineering-portal.com/power-system-stability
5. https://link.springer.com/chapter/10.1007/978-981-15-3212-2_9

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
3	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
4	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
5	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

U20EEE830	ROBOTICS AND CONTROL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To introduce basic robotic terminologies.
- To illustrate the functions of basic components of a Robot.
- To introduce manipulator dynamics and gripper types.
- To illustrate kinematics and path planning.
- To introduce dynamics and control operation.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Outline the anatomy of the Robot
CO2 - Represent the given robot as kinematic mathematical modeling
CO3 - Analyze the manipulator and gripper operation.
CO4 - Develop kinematic and path planning equations for standard configurations.
CO5 - Familiarize various control schemes of Robotics control

UNIT I INTRODUCTION (9 Hrs)

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots.

UNIT II MODELING OF ROBOTS (9 Hrs)

Mechanical structure and notations – Description of links and joints – kinematics modeling of the manipulator – Denavit - Haternberg notation – Kinematic relationship between adjacent links – Manipulator transformation matrix – Inverse matrix

UNIT III MANIPULATORS AND GRIPPERS DIFFERENTIAL MOTION (9 Hrs)

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV KINEMATICS AND PATH PLANNING (9 Hrs)

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance Solution kinematics problem – robot programming languages

UNIT V DYNAMICS AND CONTROL AND APPLICATIONS (9 Hrs)

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model –Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator. Mutiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Text Books

1. Saeed B Niku, "Introduction to Robotics Analysis, Control, Applications", John Wiley and Sons, 2nd Edition 2010.
2. Mittal R K and Nagarath I J, "Robotics and Control", Tata McGraw Hill, 1st Edition 2005.
3. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore,2015.

Reference Books

1. AshitavaGhoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, 6th Edition 2010.
2. Spyros G Tzafestas, "Introduction to Mobile Robot Control", Elsevier Science, 1st Edition 2018
3. K. K.AppuKuttan, "Robotics", I K International Publication, 1st Edition 2007.
4. Bijoy K. Ghosh, T. J. Tarn, Ning Xi, "Control in Robotics and Automation: Sensor Based Integration", Academic Press, 2nd Edition, 2011
5. Richard D Klafter, Thomas A.Chmielewski and Michael Negin, "Robotic Engineering: An Integrated approach", Prentice Hall of India, New Delhi, 1st Edition, 1989.
6. John J. Craig, "Introduction to Robotics, Mechanics and Control", Addison – Wesley Publication, 3rd Edition 2018

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3. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/
4. https://see.stanford.edu/course/cs223a
5. https://www.coursera.org/learn/mobile-robot#syllabus

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
2	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
3	3	2	2	3	-	-	-	-	-	-	-	1	2	1	1
4	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
5	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Annexure – V

Academic Calendars (B.Tech – I, III and IV years)

Use of Cell Phones

It has been decided **not to permit cell phones inside the college campus**. If any student is found using the cell phone inside the college campus, it would be confiscated and will not be returned back on any circumstances. Hence the students are instructed not to attend the college with the mobile phones.

Dress Code

The students are requested to attend the college neatly dressed. While the male students should attend the college with the shirts neatly tucked in and with the shoes, the female students are permitted to come with churidar and dupatta properly pined. Students wearing full hand shirts should wear it as such without folding it to half etc. Casual wears like jeans, T-shirts etc., both for boys and girls are strictly prohibited inside the campus. Each department has prescribed uniforms for the labs. The students are requested to strictly adhere to the dress codes as well as the rules and regulations of the college.

Maintenance of Discipline

Discipline is an important factor that shapes one's personality. It is considered as a golden key capable of opening many doors. This institution expects each and every student to follow the rules and regulations in total. Maintaining discipline in the campus will promote a conducive environment for studies.

Working hours

Online class				Regular class			
I hour	09.30 a.m	to	10.25 a.m	I hour	09.00 a.m	to	09.50 a.m
Break	10.25 a.m	to	10.30 a.m	II hour	09.50 a.m	to	10.40 a.m
II hour	10.30 a.m	to	11.25 a.m	Break	10.40 a.m	to	10.55 a.m
Break	11.25 a.m	to	11.30 p.m	III hour	10.55 a.m	to	11.45 a.m
III hour	11.30 a.m	to	12.25 p.m	IV hour	11.45 a.m	to	12.35 p.m
IV hour	01.30 p.m	to	02.25 p.m	V hour	01.15 p.m	to	02.05 p.m
Break	02.25 p.m	to	02.30 p.m	VI hour	02.05 a.m	to	02.55 p.m
V hour	02.30 p.m	to	03.25 p.m	Break	02.55 p.m	to	03.10 p.m
Break	03.25 p.m	to	03.30 p.m	VII hour	3.00 p.m	to	04.00 p.m
VI hour	03.30 p.m	to	04.25 p.m	VIII hour	04.00 p.m	to	04.50 p.m
Lunch break 12.25 p.m. to 1.30 p.m.				Lunch break 12.35 p.m. to 1.15 p.m.			

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

An Autonomous Institution

(Accredited by NBA-AICTE, New Delhi, NAAC with "A" Grade)

Madagadipet, Puducherry - 605 107

Academic Calendar

July 2021 to December 2021

Name :

Department :

Year / Sem :

நீங்கள்

அன்பு செய்யுங்கள், யாருக்கும் அடிமையாகாதீர்கள்;
இரக்கம் காட்டுங்கள், எவரிடத்தும் ஏமாந்துவிடாதீர்கள்;
பணிவைப் போற்றுங்கள், எந்த நிலையிலும் கோழையாகாதீர்கள்;
கண்டிப்பாக இருங்கள், எப்போதும் கோபப்படாதீர்கள்;
சிக்கனமாக வாழுங்கள், கருமியாக மாறாதீர்கள்;
வீரமாக இருங்கள், போக்கிரிகளாக மாறாதீர்கள்;
சுறுசுறுப்பாக இருங்கள், பதட்டம் அடையாதீர்கள்;
பொருளைத் தேடுங்கள், பேராசைப் படாதீர்கள்;
உழைப்பை நம்புங்கள், உருப்படுவீர்கள்;
உண்மையை நம்புங்கள், உயர்வடைவீர்கள்!

என்றும் அன்புடன்,
ஆசிரியர்கள்.

About Autonomous

Sri Manakula Vinayagar Engineering College has been conferred with Autonomous Status by the University Grants Commission on 26th September 2019 and the same was approved by Pondicherry University on 19th June 2020. SMVEC Autonomous Regulations R2019, will be followed for the students admitted in the Academic Year 2019-20(present Second Year). SMVEC Autonomous Regulations R2020, will be followed for the students admitted in the Academic Year 2020-21(present first Year)

HIGHLIGHTS OF SMVEC AUTONOMOUS REGULATIONS 2019 & CURRICULUM

- Industry 4.0 ready curriculum
- Curriculum towards skill development and to create more job opportunities
- Multidisciplinary curriculum
- Oriented towards entreprenurship development
- Choice to learn IELTS / Foreign Languages
- Department wise Gold Medals
- Results will be declared within a month after completion of examinations
- Supplementary Examination in 5th and 8th semester for the students having 2 arrears

- **Ethnotech / Mandatory course**

  The Institute has Established 17 Center of Excellence to provide 75 International Certification courses from IBM, Google, Cisco, e Plan, Microsoft, Autodesk, Texas instruments, Festo, Bentley, Schneider Electric, Amazon web services, Siemens, Tally, DELL EMC², Harita Techserv, PTC, LN an Excellence in Technology & Didactic solutions. All students should enroll in certification course from semester-I to semester-VI.

- **Industrial Training / Internship**

  Students may undergo training or internship during summer / winter vacation at Industry/ Research organization. Students are also permitted to undergo internships during their eighth semester after the completion of theory classes.

DEC 2021

Date	Day	Schedule	Working day/ Holiday
1	Wed	Tentative End Semester Examination Starts	
2	Thu		
3	Fri		
4	Sat		
5	Sun		Holiday
6	Mon		
7	Tue		
8	Wed		
9	Thu		
10	Fri		
11	Sat	End Semester Examination Ends	
12	Sun		Holiday
13	Mon		
14	Tue		
15	Wed		
16	Thu		
17	Fri		
18	Sat		
19	Sun		Holiday
20	Mon	Tentative End Semester Practical Examination Starts	
21	Tue		
22	Wed		
23	Thu		
24	Fri	End Semester Practical Examination Ends	
25	Sat	Christmas	Holiday
26	Sun		Holiday
27	Mon		
28	Tue		
29	Wed	**Commencement of VI & III semester classes**	
30	Thu		
31	Fri		

Total number of working days : -
Total number of holiday : 5

நீ வெற்றியடைவதை உன்னைத் தவிர, வேறு யாராலும் தடுக்க முடியாது – ப்ரெமர்

NOV 2021

Date	Day	Schedule	Working day/ Holiday
1	Mon	**Puducherry Liberation Day**	Holiday
2	Tue		50(44)
3	Wed		51(45)
4	Thu	**Diwali**	Holiday
5	Fri		52(46)
6	Sat		53(47)
7	Sun		Holiday
8	Mon		54(48)
9	Tue		55(49)
10	Wed		56(50)
11	Thu		57(51)
12	Fri		58(52)
13	Sat		59(53)
14	Sun		Holiday
15	Mon		60(54)
16	Tue		61(55)
17	Wed		62(56)
18	Thu		63(57)
19	Fri	QCM meeting - 3(III Year & I Year)	64(58)
20	Sat	Feedback from the students & Analysis(III Yr & I Yr)	65(59)
21	Sun		Holiday
22	Mon	CAT-3 for III Year & I Year (2 units)	66(60)
23	Tue		67(61)
24	Wed		68(62)
25	Thu		69(63)
26	Fri		70(64)
27	Sat		71(65)
28	Sun		Holiday
29	Mon		72(66)
30	Tue	Submission of Attendance & Assessment -Term III	73(67)

Total number of working days : 24
Total number of holiday : 6

நீ வெற்றியடைவதை உன்னைத் தவிர, வேறு யாராலும் தடுக்க முடியாது – ப்ரெமர்

❖ **Supplementary Examinations**

Supplementary examination is an additional examination conducted within a month of time after declaring the results of end semester examination. In order to complete the program within 4 years, only the student with maximum of two arrears will be permitted to appear for supplementary examination. The supplementary examination will be conducted in fifth and eighth semester only. For supplementary examination, the continuous assessment marks of the last attempt will be considered.

Benefits

- ❖ More number of students will receive the degree within the stipulated time
- ❖ The industries prefers to recruit students with no standing arrear. If the supplementary examinations is conducted then more number of students will be eligible for the recruitment

❖ **Photo copy of answer book**

After the publication of the result, photocopy of the answer books shall be provided to the student on request with stipulated fee fixed by the College from time to time

Punctuality in Attendance

The students are requested to keep up punctuality in attending the college. The late comers will be losing their attendance and in turn the internal marks. Hence all the students are requested to attend the college in time. A student shall be permitted to appear for the End Semester Examination at the end of the semester only if he / she **secures not less than 75% of overall attendance.**

Redo Category

A student who secures overall attendance which is less than 60% has to repeat the course with the approval, when it is next offered.

Tutor Ward System

In the tutor ward system, 30 students are allotted to a tutor who will be taking care of these students. The students are requested to utilize the facility.

Marks Distribution of Continuous Assessment Marks (CAM) and End Semester Examination Marks (ESM)

Scheme for Continuous Assessment Test(CAT)

S. No	Course Type	Continues Assessment components									
		Test Marks	Average of pre/post test/ viva for each experiment	Average of marks for experiment report for each experiment	Model Exam / Report	Assignment	Review - 1	Review - 2	Review - 3	Attendance	
1.	Theory	15	-	-	-	5	-	-	-	5	25
2.	Practical	-	10	15	15	-	-	-	-	10	50
3.	Project work	-	-	-	-	-	10	10	20	-	40

The internal marks will be provided fully based on the continuous assessment tests (CAT 1 to 4)

Weightage of Assessment for Theory Course

S. No.	Test	Portion for Test	Test Marks	Duration of Test	Weightage for Internal
1	CAT 1	1½ Units	50	1 ½ hours	10
2	CAT 2	1½ Units	50	1 ½ hours	
3	CAT 3	5 Units	100	3 hours	05
Continuous Assessment for Theory Course					15

Question Paper Pattern

Question paper for CAT and ESE will be based on the patterns shown in Table (a) and (b)

Table (a) Question Paper pattern for CAT

Test Type	2 Marks	5 Marks	10 Marks	Total Marks
CAT 1 to 2	5(questions) (10 Marks)	4(questions) (20 Marks)	2 (questions) (20 Marks)	50
CAT 3	End semester Examination Question Pattern			75

Table (b) Question paper pattern for End semester Examination(ESE)

2 Marks	5 Marks	10 Marks	Total Marks
10(20 Marks)	5 (25 Marks) (one questions from each unit)	3 (30 Marks) (out of 5 questions)	75

October 2021

Date	Day	Schedule	Working day/ Holiday
1	Fri	QCM meeting - 1(I Year)	28(22)
2	Sat	Gandhi Jayanthi	Holiday
3	Sun		Holiday
4	Mon	CAT-1 for I Year (1 1/2 units)	29(23)
5	Tue		30(24)
6	Wed		31(25)
7	Thu		32(26)
8	Fri		33(27)
9	Sat	Special coaching classes / GP / Seminar / Vanavil Art / GL/Placement / Academy activities	34(28)
10	Sun		Holiday
11	Mon		35(29)
12	Tue		36(30)
13	Wed		37(31)
14	Thu	Saraswathi Pooja	Holiday
15	Fri	Vijayadasamy	Holiday
16	Sat		38(32)
17	Sun		Holiday
18	Mon		39(33)
19	Tue	Miladi Nabi	Holiday
20	Wed		40(34)
21	Thu		41(35)
22	Fri		42(36)
23	Sat	Special coaching classes / GP / Seminar / Vanavil Art / GL/Placement / Academy activities	43(37)
24	Sun		Holiday
25	Mon	QCM meeting - 2(III Year & I Year)	44(38)
26	Tue	Feedback from the students & Analysis(III Yearr & I Yearr)	45(39)
27	Wed	CAT-2 for III Year & I Year (1 1/2 units)	46(40)
28	Thu		47(41)
29	Fri		48(42)
30	Sat	Submission of Attendance & Assessment -Term II	49(43)
31	Sun		Holiday

Total number of working days : 22

Total number of holiday : 9

வெற்றி என்பது, லட்சியத்தைப் படிப்படியாகப் புரிந்து கொள்வது – நைட்டிங்கேல்

September 2021

Date	Day	Schedule	Working day/ Holiday
1	Wed		
2	Thu		
3	Fri		
4	Sat		
5	Sun		Holiday
6	Mon	**End Semester Practical Exam(ESPE)for II year starts**	
7	Tue		
8	Wed		
9	Thu	ESPE Ends for II Year/ Lab Practice for I Year starts	
10	Fri	**Vinayagar Chathurthi**	Holiday
11	Sat	Special coaching classes / GP / Seminar / Vanavil Art / GL/Placement / Academy activities	
12	Sun		Holiday
13	Mon	V Semester Classes Continues for III Year	12
14	Tue		**13**
15	Wed	End Semester Practical Exam(ESPE)for I year starts	14
16	Thu		15
17	Fri		16
18	Sat	End Semester Practical Exam(ESPE)for I year Ends	17
19	Sun		Holiday
20	Mon	II Semester Classes Continues for I year	18(12)
21	Tue		19(13)
22	Wed		**20(14)**
23	Thu		21(15)
24	Fri	Feedback from the students & Analysis(III Year)	22(16)
25	Sat	QCM meeting - 1(III year)	23(17)
26	Sun		Holiday
27	Mon	**CAT-1 for III Year (1 1/2 units)**	24(18)
28	Tue		25(19)
29	Wed	**Feedback from the students & Analysis(I Year)**	26(20)
30	Thu	**Submission of Attendance & Assessment -Term II**	27(21)

Total number of working days : 16
Total number of holiday : 5

சலித்துக் கொள்பவன் ஒவ்வொரு வாய்ப்பிலும் உள்ள ஆபத்தைப் பார்க்கிறான். சாதிப்பவன் ஒவ்வொரு ஆபத்திலும் உள்ள வாய்ப்பினைப் பார்க்கிறான்.

Distribution of Attendance marks for theory : 5 marks

The distribution of 5 marks for theory class attendance is as follows :
5 marks for 95% attendance and above
4 marks for 90% attendance and above but below 95%
3 marks for 85% attendance and above but below 90%
2 marks for 80% attendance and above but below 85%
1 mark for 75% attendance and above but below 80%

Distribution of Attendance marks for practical : 10 marks

The distribution of 10 marks for practical class attendance is as follows :
10 marks for 95% attendance and above
8 marks for 90% attendance and above but below 95%
6 marks for 85% attendance and above but below 90%
4 marks for 80% attendance and above but below 85%
2 marks for 75% attendance and above but below 80%

Note :

Students should not be absent for the online classes/regular classes. Attendance for the online classes/regular classes are monitored regularly and it is recorded. Continuous assessment mark will be based on the performance of the students in the continuous assessment test, assignment and attendance percentage.

Assignments : 5 marks

Out of 25 continuous assessement marks, 5 marks will be awarded for the assignment. The assignment questions will be different for each and every student.The students have to submit 3 assignments in each subject. Best of 2 out of 3 assignments will be consider.

Importance of Continuous Assessment Marks(CAM)

The continuous assessment marks once earned are carried over to the subsequent exams also. Hence the students are requested to work hard to get the maximum continous assessment marks. If the continuous assessment marks are lower, it will pull down chances of getting the first class, distinction, gold medals and ranks.

Importance of CAT-I/CAT-II/CAT-III/ Practical Model Examination

Continuous assessment marks are awarded for the performance in the CAT-I, CAT-II & CAT-III Hence all the students are requested to prepare well for each test / examination to earn the maximum continuous assessment marks.

Undertaking Minor / Major Projects

Each student is advised to take atleast one minor project. Involving in the project will be helping to understand the basics of the subject. Some of the minor / major project will also be benefiting the society. Moreover, the Management awards cash prizes for the best projects in each department.

Participation in the Curricular / Co-curricular / Extra curricular Activities

All the students are encouraged to participate in the curricular / co-curricular / extra curricular activities. Involvement in these activities will improve their knowledge level in the subject. If a student or a team gets cash prize / award in the technical event organized by the recognised institutions, then the management of this institution will also sanction an amount equivalent to the winning award / cash prize as a token of appreciation.

Leave Account Record

For each student, leave account record has been provided. The students are instructed to show the leave record to their parents and strictly adhere to the instructions given for availing the leave. The leave account record should be maintained properly and prior approval must be obtained for availing the leave. In exceptional cases, the students are permitted to get the approval after availing the leave.

Transport Facility

61 buses have been arranged for the students to reach the college from Puducherry, Kanagachettikulam, Villupuram, Neyveli, Panruti, Cuddalore, Nellikuppam, Madukarai, Tindivanam, Tiruvannamalai and virudhachalam covering almost all the areas. Separate transport facility has been arranged for the students who remain in the college after 5 p.m. for utilising computer lab, library and sports facilities. The students are requested to utilise the transport facility.

All the students are requested to avoid mobile phones and travel by two wheelers considering their safety and security.

August 2021

Date	Day	Schedule	Working day/ Holiday
1	Sun	Study holidays starts for ESE	Holiday
2	Mon		Holiday
3	Tue		Holiday
4	Wed		Holiday
5	Thu		Holiday
6	Fri		Holiday
7	Sat		Holiday
8	Sun		Holiday
9	Mon		Holiday
10	Tue		Holiday
11	Wed		Holiday
12	Thu		Holiday
13	Fri		Holiday
14	Sat		Holiday
15	Sun	Independence Day / Alumini meeting	Holiday
16	Mon	De jure Transfer Day	Holiday
17	Tue	Study holidays Ends for Even sem ESE 2021	Holiday
18	Wed	I & IV Sem ESE 2020 starts	
19	Thu		
20	Fri		
21	Sat		
22	Sun		Holiday
23	Mon		
24			
25	Wed		
26	Thu		
27	Fri		
28	Sat	IV Sem ESE Ends	
29	Sun		Holiday
30	Mon	Lab practice for II year	
31	Tue		

Total number of working days : -
Total number of holiday : 19

அன்றாட வாழ்வின் சாதாரண விஷயங்களையும், அசாதாரண முறையில் செய்யும்போது உலகின் கவனத்தை உன் மீது திருப்ப முடியும். - ஜார்ஜ்வாஷிங்டன்கார்வெர்

July 2021

Date	Day	Schedule	Working day/ Holiday
1	Thu		
2	Fri		
3	Sat		
4	Sun		Holiday
5	Mon		
6	Tue		
7	Wed		
8	Thu		
9	Fri		
10	Sat		
11	Sun		Holiday
12	Mon		
13	Tue		
14	Wed		
15	Thu		
16	Fri		
17	Sat		
18	Sun		Holiday
19	Mon	Commencement of V & II semester classes	1(1)
20	Tue		2(2)
21	Wed	Bakridh	Holiday
22	Thu		3(3)
23	Fri		4(4)
24	Sat		5(5)
25	Sun		Holiday
26	Mon		6(6)
27	Tue		7(7)
28	Wed		8(8)
29	Thu		9(9)
30	Fri		10(10)
31	Sat		11(11)

Total number of working days : 11
Total number of holiday :2

தளராத இதயம் உள்ளவனுக்கு, இவ்வுலகில் முடியாதது என்று எதுவுமே இல்லை
– புக்கன்ஸ்

Placement and Training Division

The placement cell functions round the clock throughout the year to establish contact with reputed multinational companies, well established industrial organizations and plays an important role by providing training to the students for various job opportunities and placing large number of the students every year at these organizations.

Activities of the Training Division

- ☆ Arranges trainings for personality and interpersonal skill development.
- ☆ Assists the students to get in-plant training
- ☆ Arranges industrial visits
- ☆ Creates awareness on the opportunities open for higher studies.
- ☆ Arranges coaching classes for GATE, GRE, TOFEL, IELTS, IAS, IES etc.

Placement Record

Academic Year	Students Placed
2013-14	85%
2014-15	95%
2015-16	95%
2016-17	93%
2017-18	95%
2018-19	95%
2019-20	95%
2020-21	96%

Details of Placed Students : 2020 - 21

KAAR Technologies	10	CSS	23
ZOHO	8	Accenture	13
Hexaware	16	HCL Technologies	4
TCS(Ninja and Digital)	259	Sutherland	167
Yellow Messanger	4	TechMahindra	2
Unisys	1	Byjus	2
Embed Ur	1	Reliance Retail	9
Infosys	1	Excelcomm	2
Virtusa	3	ICICI	13
CTS	110	others	168
Wipro	16	**Total**	**832**

Wi-Fi Campus

Our campus has been enabled by high speed uninterrupted Wi-Fi connectivity. The Computer Centre is open till 8.00 p.m. on all the working days except on the dates of University examinations.

Library Working Hours

8.30 a.m. to 8.30 p.m. (On all the working days)
8.30 a.m. to 10.00 p.m. (During the examination days)

Women Cell

For the benefit of the girl students, a Women Cell has been constituted in the college. The girl students may approach the Chairperson / members for assistance.

Grievance Redressal Cell

There is a Grievance Redressal Cell under the Chairmanship of the Director of the institution. Students are requested to approach the Chairman / members to redress their grievances. Mail ID : grievance@smvec.ac.in

Gold Medals and Top Ten Ranks

Your seniors were sincere, hard working and got the Gold medals of the Pondicherry University and the top ten ranks in all the branches. The details of the University Goldmedals and Top Ten Ranks won by the students are given below.

1 Indicates the Gold medal and University First Rank.

For the Award of Gold Medal and ranks for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first five candidates in each branch of study.

Name of the Course	Year		
	2017	2018	2019
B.Tech. EEE	2, 4, 6, 7	1	1 2,3,4,6,7,8,9,10
B.Tech. ECE	2,3,4,5,6,7,8,9,10		1 ,3,4,5,6,7,9,10
B.Tech. CSE	1 ,2, 3, 4, 10		1 ,2,4,6,7,8,10
B.Tech. IT	1 ,2,3,4,5,6,7,8,9,10		1 2,3,5,6,8
B.Tech. ICE	1 ,2,3,4,5,6,7,8,9,10	1	1 2,3,4,5,6,7,8,9,10
B.Tech. Mech	1 ,4, 5, 7, 9, 10		3,7,8,10
B.Tech. Civil	2, 3, 10		2,3,4,6,7,10
MCA	3,4,7,9,10		1 2,6,7,8,9,10,11
MBA	1 3, 4, 6, 7, 8		1 2,3,4,5,7,8,10
M.Tech. CSE	1 2, 3, 4, 5, 7, 8, 9		1 ,7
M.Tech. ECE	2, 3, 6, 7, 8, 9		2,3,4,5
M.Tech. PED	1		1 ,2,3
M.Tech. N/W	1 2, 3, 4, 5, 7, 8, 9		1 ,2,3
M.Tech(VLSI)	1		1 ,2,3,4
M.Tech(MF)	1 ,2		1

Important points for the kind attention of the Parents

Dear Parent

The V and II semester classes commences on 19th July2020. The above mentioned semester is a very short term, including working days meant for model exam. The students have to complete a lot of work within a short period. **Hence the parents are kindly requested not to permit their wards to avail frequent leave during this semester period for the following reasons.**

V Semester (III Year) & II Semester(I Year) : All the V & II semester papers are considered as problematic (toughest) papers. Hence, regular attendance and more concentration are required to clear these semester papers.

Marks in the **continuous assessment test** decide the major part of the continuous assessment marks. So, availing leave for the continuous assessment test must be avoided at any cost as this would seriously affect the continuous assessment marks.

Practicals are very important not only to score more marks but also it will help to understand the theory part of the subject, hence advice your ward not to avail leaves during practical classes.

Please spare your **valuable time to talk to your son/daughter every day and try to understand what he/she is doing in respect of his/her studies.** Kindly extend all your support to your son/daughter which will help them to come out successfully. For any assistance from our side you may always feel free to contact the respective Coordinator / HOD any time during the working hours.

Use of Cell Phones

It has been decided **not to permit cell phones inside the college campus**. If any student is found using the cell phone inside the college campus, it would be confiscated and will not be returned back on any circumstances. Hence the students are instructed not to attend the college with the mobile phones.

Dress Code

The students are requested to attend the college neatly dressed. While the male students should attend the college with the shirts neatly tucked in and with the shoes, the female students are permitted to come with churidar and dupatta properly pined. Students wearing full hand shirts should wear it as such without folding it to half etc. Casual wears like jeans, T-shirts etc., both for boys and girls are strictly prohibited inside the campus. Each department has prescribed uniforms for the labs. The students are requested to strictly adhere to the dress codes as well as the rules and regulations of the college.

Maintenance of Discipline

Discipline is an important factor that shapes one's personality. It is considered as a golden key capable of opening many doors. This institution expects each and every student to follow the rules and regulations in total. Maintaining discipline in the campus will promote a conducive environment for studies.

Online class			Working hours			Regular class		
I hour	09.30 a.m	to 10.25 a.m	I hour	09.00 a.m	to 09.50 a.m			
Break	10.25 a.m	to 10.30 a.m	II hour	09.50 a.m	to 10.40 a.m			
II hour	10.30 a.m	to 11.25 a.m	Break	10.40 a.m	to 10.55 a.m			
Break	11.25 a.m	to 11.30 p.m	III hour	10.55 a.m	to 11.45 a.m			
III hour	11.30 a.m	to 12.25 p.m	IV hour	11.45 a.m	to 12.35 p.m			
IV hour	01.30 p.m	to 02.25 p.m	V hour	01.15 p.m	to 02.05 p.m			
Break	02.25 p.m	to 02.30 p.m	VI hour	02.05 a.m	to 02.55 p.m			
V hour	02.30 p.m	to 03.25 p.m	Break	02.55 p.m	to 03.10 p.m			
Break	03.25 p.m	to 03.30 p.m	VII hour	3.00 p.m	to 04.00 p.m			
VI hour	03.30 p.m	to 04.25 p.m	VIII hour	04.00 p.m	to 04.50 p.m			
Lunch break 12.25 p.m. to 1.30 p.m.			Lunch break 12.35 p.m. to 1.15 p.m.					

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

An Autonomous Institution

(Accredited by NBA-AICTE, New Delhi, NAAC with "A" Grade)

Madagadipet, Puducherry - 605 107

Academic Calendar

July 2021 to December 2021

Name :

Department :

Year / Sem : IV/VII

நீங்கள்

அன்பு செய்யுங்கள், யாருக்கும் அடிமையாகாதீர்கள்;
இரக்கம் காட்டுங்கள், எவரிடத்தும் ஏமாந்துவிடாதீர்கள்;
பணிவைப் போற்றுங்கள், எந்த நிலையிலும் கோழையாகாதீர்கள்;
கண்டிப்பாக இருங்கள், எப்போதும் கோபப்படாதீர்கள்;
சிக்கனமாக வாழுங்கள், கருமியாக மாறாதீர்கள்;
வீரமாக இருங்கள், போக்கிரிகளாக மாறாதீர்கள்;
சுறுசுறுப்பாக இருங்கள், பதட்டம் அடையாதீர்கள்;
பொருளைத் தேடுங்கள், பேராசைப் படாதீர்கள்;
உழைப்பை நம்புங்கள், உருப்படுவீர்கள்;
உண்மையை நம்புங்கள், உயர்வடைவீர்கள்!

என்றும் அன்புடன்,
ஆசிரியர்கள்.

About Autonomous

Sri Manakula Vinayagar Engineering College has been conferred with Autonomous Status by the University Grants Commission on 26th September 2019 and the same was approved by Pondicherry University on 19th June 2020. The Pondicherry University Regulations R2013 will be followed for the students admitted in the Academic Year 2017 -18 (present Final year) and for the students admitted in the Academic Year 2018 -19 (present Third year). **End semester examinations process i.e. question paper setting, answer script evaluation and result will be published by SMVEC College.**

Punctuality in Attendance

The students are requested to keep up punctuality in attending the college. The late comers will be losing their attendance and in turn the internal marks. Hence all the students are requested to attend the college in time. A student shall be permitted to appear for the End Semester Examination at the end of the semester only if he / she **secures not less than 75% of overall attendance.**

Repeating the Course

A student who secures overall attendance which is less than 60% has to repeat the course with the approval of the University when it is next offered.

Tutor Ward System

In the tutor ward system, 30 students are allotted to a tutor who will be taking care of these students. The students are requested to utilize the facility.

Continuous Assessment Marks for Theory : 25 Marks

25 marks are allotted for continuous assessment for a theory paper. Out of 25 marks 20 marks are awarded for the continuous assessment tests based on the performance of the student in the CAT-I, II & III and the remaining five marks are awarded for class attendance. The distribution of 5 marks for class attendance and the details of distribution of 25 marks for continuous assessment are as follows:

5 marks for 95% attendance and above	CAT - I,II	15 marks
4 marks for 90% attendance and above but below 95%	CAT - III	5 marks
3 marks for 85% attendance and above but below 90%	Attendance	5 marks
2 marks for 80% attendance and above but below 85%	Total	25 marks
1 mark for 75% attendance and above but below 80%		

Continuous Assessment Marks for Practical : 50 Marks

For a practical subject, where there is a end semester examination, 50 marks for external examination and 50 marks for continuous assessment are allocated. The distribution of 50 marks for Continuous assessment is as follows :

For practical class attendance	10	marks
For Model Exam/Report	15	marks
For average of marks for experiment report for each exp.	15	marks
For average of Pre /post-test/viva for each experiment	10	marks
Total	50	marks

DEC 2021

Date	Day	Schedule	Working day/ Holiday
1	Wed		40
2	Thu		41
3	Fri		**42**
4	Sat		43
5	Sun		Holiday
6	Mon		**44**
7	Tue		45
8	Wed		**46**
9	Thu		47
10	Fri	QCM meeting - 3(IV Year) **/Phase I Second review**	**48**
11	Sat	Feedback from the students & alysis(IV Year)	49
12	Sun		Holiday
13	Mon	CAT-3 for IV Year (2 units)	50
14	Tue		**51**
15	Wed		52
16	Thu		53
17	Fri		54
18	Sat		55
19	Sun		Holiday
20	Mon		
21	Tue		
22	Wed		
23	Thu		
24	Fri		
25	Sat	Christmas	Holiday
26	Sun		Holiday
27	Mon	Tentative End Semester Examination Starts	
28	Tue		
29	Wed		
30	Thu		
31	Fri		

Total number of working days : 16
Total number of holiday : 5

நீ வெற்றியடைவதை உன்னைத் தவிர, வேறு யாராலும் தடுக்க முடியாது – ப்ரெமர்

NOV 2021

Date	Day	Schedule	Working day/ Holiday
1	Mon	**Puducherry Liberation Day**	Holiday
2	Tue	CAT-1 for IV Year (1 1/2 units)	16
3	Wed		17
4	Thu	**Diwali**	Holiday
5	Fri		18
6	Sat		19
7	Sun		Holiday
8	Mon		20
9	Tue		21
10	Wed		22
11	Thu		23
12	Fri		24
13	Sat		25
14	Sun		Holiday
15	Mon		26
16	Tue		27
17	Wed		28
18	Thu		29
19	Fri	QCM meeting - 2(IV Year)/ **Phase I First review**	30
20	Sat	Feedback from the students & Analysis(IV Year)	31
21	Sun		Holiday
22	Mon	CAT-2 for IV Year (1 1/2 units)	32
23	Tue		33
24	Wed		34
25	Thu		35
26	Fri		36
27	Sat		37
28	Sun		Holiday
29	Mon		38
30	Tue	Submission of Attendance & Assessment -Term II	39

Total number of working days : 24
Total number of holiday : 6

நீ வெற்றியடைவதை உன்னைத் தவிர, வேறு யாராலும் தடுக்க முடியாது – ப்ரெமர்

The distribution of 10 marks for practical class attendance is as follows :
10 marks for 95% attendance and above
8 marks for 90% attendance and above but below 95%
6 marks for 85% attendance and above but below 90%
4 marks for 80% attendance and above but below 85%
2 marks for 75% attendance and above but below 80%

Importance of Continuous Assessment marks

The continuous assessment marks once earned are carried over to the subsequent exams also. Hence the students are requested to work hard to get the maximum continuous assessment marks. If the continuous assessment marks are lower, it will pull down chances of getting the first class, distinction, gold medals and ranks.

Importance of CAT-I/CAT-II/CAT-III/ Practical Model Examination

Continous assessment marks are awarded for the performance in the CAT-I, CAT-II & CAT-III. Hence all the students are requested to prepare well for each test / examination to earn the maximum continuous assessment marks.

Undertaking Minor / Major Projects

Each student is advised to take atleast one minor project. Involving in the project will be helping to understand the basics of the subject. Some of the minor / major project will also be benefiting the society. Moreover, the Management awards cash prizes for the best projects in each department.

Participation in the Curricular / Co-curricular / Extra curricular Activities

All the students are encouraged to participate in the curricular / co-curricular / extra curricular activities. Involvement in these activities will improve their knowledge level in the subject. If a student or a team gets cash prize / award at the technical event organised by the recognised institutions, then the management of this institution will also sanction an amount equivalent to the award / cash prize as a token of appreciation.

Leave Account Record

For each student, leave account record has been provided. The students are instructed to show the leave record to their parents and strictly adhere to the instructions given for availing the leave. The leave account record should be maintained properly and prior approval must be obtained for availing the leave. In exceptional cases, the students are permitted to get the approval after availing the leave.

Transport Facility

61 buses have been arranged for the students to reach the college from Puducherry, Kanagachettikulam, Villupuram, Neyveli, Panruti, Cuddalore, Nellikuppam, Madukarai, Tindivanam, Tiruvannamalai and virudhachalam covering almost all the areas. Separate transport facility has been arranged for the students who remain in the college after 5 p.m. for utilising computer lab, library and sports facilities. The students are requested to utilise the transport facility.

All the students are requested to avoid mobile phones and travel by two wheelers considering their safety and security.

Placement and Training Division

The placement cell functions round the clock throughout the year to establish contact with reputed multinational companies, well established industrial organizations and plays an important role in locating various job opportunities and placing large number of the students every year at these organizations.

Activities of the Training Division

- ☆ Arranges trainings for personality and interpersonal skill development.
- ☆ Assists the students to get in-plant training
- ☆ Arranges industrial visits
- ☆ Creates awareness on the opportunities open for higher studies.
- ☆ Arranges coaching classes for GATE, GRE, TOFEL, IELTS, IAS, IES etc.

Placement Record

Academic Year	Students Placed
2013-14	85%
2014-15	95%
2015-16	95%
2016-17	93%
2017-18	95%
2018-19	95%
2019-20	95%
2020-21	96%

Details of Placed Students : 2020 - 21

KAAR Technologies	10	CSS	23
ZOHO	8	Accenture	13
Hexaware	16	HCL Technologies	4
TCS(Ninja and Digital)	259	Sutherland	167
Yellow Messanger	4	TechMahindra	2
Unisys	1	Byjus	2
Embed Ur	1	Reliance Retail	9
Infosys	1	Excelcomm	2
Virtusa	3	ICICI	13
CTS	110	others	168
Wipro	16	**Total**	**832**

Wi-Fi Campus

Our campus has been enabled by high speed uninterrupted Wi-Fi connectivity. The Computer Centre is open till 8.00 p.m. on all the working days except on the dates of University examinations.

Library Working Hours

8.30 a.m. to 8.30 p.m. (On all the working days)
8.30 a.m. to 10.00 p.m. (During the examination days)

Women Cell

For the benefit of the girl students, a Women Cell has been constituted in the college. The girl students may approach the Chairperson / members for assistance.

Grievance Redressal Cell

There is a Grievance Redressal Cell under the Chairmanship of the Director of the institution. Students are requested to approach the Chairman / members to redress their grievances. Mail ID : grievance@smvec.ac.in

October 2021

Date	Day	Schedule	Working day/ Holiday
1	Fri		
2	Sat	Gandhi Jayanthi	Holiday
3	Sun		Holiday
4	Mon		
5	Tue	Lab Practice for VI semester ends	
6	Wed	**End Semester Practical Exam starts for VI sem**	
7	Thu		
8	Fri		
9	Sat	End Semester Practical Exam ends for **VI sem**	
10	Sun		Holiday
11	Mon	**Commencement of VII semester classes**	1
12	Tue		2
13	Wed		3
14	Thu	Saraswathi Pooja	Holiday
15	Fri	Vijayadasamy	Holiday
16	Sat		4
17	Sun		Holiday
18	Mon		5
19	Tue	Miladi Nabi	Holiday
20	Wed		6
21	Thu		7
22	Fri		8
23	Sat		9
24	Sun		Holiday
25	Mon		10
26	Tue		11
27	Wed		12
28	Thu	QCM meeting - 1(IV Year) **/ Phase I Zeroth review**	13
29	Fri	Feedback from the students & Analysis(IVYear)	14
30	Sat	Submission of Attendance & Assessment -Term I	15
31	Sun		Holiday

Total number of working days : 15
Total number of holiday : 9

வெற்றி என்பது, லட்சியத்தைப் படிப்படியாகப் புரிந்து கொள்வது – நைட்டிங்கேல்

September 2021

Date	Day	Schedule	Working day/ Holiday
1	Wed		
2	Thu		
3	Fri		
4	Sat		
5	Sun		Holiday
6	Mon		
7	Tue		
8	Wed		
9	Thu		
10	Fri	Vinayagar Chathurthi	Holiday
11	Sat		
12	Sun		Holiday
13	Mon		
14	Tue		
15	Wed		
16	Thu		
17	Fri		
18	Sat		
19	Sun		Holiday
20	Mon		
21	Tue		
22	Wed		
23	Thu		
24	Fri		
25	Sat		
26	Sun		Holiday
27	Mon	Lab Practice for VI semester starts	
28	Tue		
29	Wed		
30	Thu		

Total number of working days : -
Total number of holiday : 5

சலித்துக் கொள்பவன் ஒவ்வொரு வாய்ப்பிலும் உள்ள ஆபத்தைப் பார்க்கிறான்.
சாதிப்பவன் ஒவ்வொரு ஆபத்திலும் உள்ள வாய்ப்பினைப் பார்க்கிறான்.

Gold Medals and Top Ten Ranks

Your seniors were sincere, hard working and got the Gold medals of the Pondicherry University and the top ten ranks in all the branches. The details of the University Goldmedals and Top Ten Ranks won by the students are given below.

1 Indicates the Gold medal and University First Rank.

For the Award of Gold Medal and ranks for each branch of study, the CGPA secured from 1st to 8th semester alone should be considered and it is mandatory that the candidate should have passed all the subjects from 1st to 8th semester in the first attempt. Rank certificates would be issued to the first five candidates in each branch of study.

Name of the Course	Year		
	2017	2018	2019
B.Tech. EEE	2, 4, 6, 7	1	1 2,3,4,6,7,8,9,10
B.Tech. ECE	2,3,4,5,6,7,8,9,10		1 ,3,4,5,6,7,9,10
B.Tech. CSE	1 ,2, 3, 4, 10		1 ,2,4,6,7,8,10
B.Tech. IT	1 ,2,3,4,5,6,7,8,9,10		1 2,3,5,6,8
B.Tech. ICE	1 ,2,3,4,5,6,7,8,9,10	1	1 2,3,4,5,6,7,8,9,10
B.Tech. Mech	1 ,4, 5, 7, 9, 10		3,7,8,10
B.Tech. Civil	2, 3, 10		2,3,4,6,7,10
MCA	3,4,7,9,10		1 2,6,7,8,9,10,11
MBA	1 3, 4, 6, 7, 8		1 2,3,4,5,7,8,10
M.Tech. CSE	1 2, 3, 4, 5, 7, 8, 9		1 ,7
M.Tech. ECE	2, 3, 6, 7, 8, 9		2,3,4,5
M.Tech. PED	1		1 ,2,3
M.Tech. N/W	1 2, 3, 4, 5, 7, 8, 9		1 ,2,3
M.Tech(VLSI)	1		1 ,2,3,4
M.Tech(MF)	1 ,2		1

Important points for the kind attention of the Parents

Dear Parent

The VII semester classes commence on 11th October 2021. The above mentioned semester is a very short term, including working days meant for CAT-III. The students have to complete a lot of work within a short period. **Hence the parents are kindly requested not to permit their wards to avail frequent leave during this semester period for the following reasons.**

VII Semester (IV year): The students have to complete their **Major Project in time**. Besides, they have to prepare for the End Semester theory examinations also. Hence, all the students are expected to devote their time to attend to the above work. **The students selected at the campus interview will be permitted to join by authorities of the companies, only if they qualify for the degree.**

For the final year students, Saturdays are allotted for Project work. The 'Project work" is an important component and in some cases it decides on the spot placement. Hence, the final year students are advised to use the **Saturdays only for completing projects and not for any other purpose as such an attitude shall affect the Project Work as well as their future.**

Marks in the **continuous assessment test** decide the major part of the continous assessment marks. So, availing leave for the continuous assessment test must be avoided at any cost as this would seriously affect the assessment marks.

Practicals are very important not only to score more marks but also it will help to understand the theory part of the subject, hence advice your ward not to cut the practical classes.

Please spare your **valuable time to talk to your son/daughter every day and try to understand what he/she is doing in respect of his/her studies.** Kindly extend all your support to your son/daughter which will help them to come out successfully. For any assistance from our side you may always feel free to contact the respective Coordinator / HOD any time during the working hours.

August 2021

Date	Day	Schedule	Working day/ Holiday
1	Sun	Study holidays starts for ESE	Holiday
2	Mon		Holiday
3	Tue		Holiday
4	Wed		Holiday
5	Thu		Holiday
6	Fri		Holiday
7	Sat		Holiday
8	Sun		Holiday
9	Mon		Holiday
10	Tue		Holiday
11	Wed		Holiday
12	Thu		Holiday
13	Fri		Holiday
14	Sat		Holiday
15	Sun	Independence Day / Alumini meeting	Holiday
16	Mon	De jure Transfer Day	Holiday
17	Tue	Study holidays Ends for Even sem ESE 2021	Holiday
18	Wed	VI Sem ESE 2020 starts	
19	Thu		
20	Fri		
21	Sat		
22	Sun		Holiday
23	Mon		
24			
25	Wed		
26	Thu		
27	Fri		
28	Sat	VI Sem ESE Ends	
29	Sun		Holiday
30	Mon	Placement Training starts	
31	Tue		

Total number of working days : -
Total number of holiday : 19

அன்றாட வாழ்வின் சாதாரண விஷயங்களையும், அசாதாரண முறையில் செய்யும்போது உலகின் கவனத்தை உன் மீது திருப்ப முடியும். - ஜார்ஜ்வாஷிங்டன்கார்வெர்

Annexure – VI

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of ELECTRICAL AND ELECTRONICS ENGINEERING
DETAILS OF EXAMINERS FOR QUESTION PAPER SETTER AND EVALUATORS

Sl.No	Name of the Examiner	Specialization	Year of Experience	Designation, Department and Institution in which currently working	Contact number and mail id
1.	Dr.S.P.Mangaiyarkarasi	Power System	16	Asst.Professor , Department of EEE, University college of Engineering, Panruti.	mangaisowmeya@gmail.com 8903678363
2.	Dr.N.Shobanadevi	Power Electronics and Drives	20	Professor , University College of Engineering, Ariyalur.	shobanadevi1975@gmail.com 8778149535
3.	Dr.D.Zamrooth	Power Electronics	21	Asst.Professor, Department of EEE, University college of Engineering, Kanchipuram	zam.shireen@gmail.com 91767 73605
4.	Dr.S.A.Elankurisil	Power Electronics	15	Professor & Head, Department of EEE, Adhiparasakthi Engineering College, Melmaruvathur.	saelankurisil@gmail.com 9442936797
5.	Dr.A.Saraswathi	Power Electronics	18	Asst.Professor, Department of EEE, University college of Engineering - Villupuram	saraswathiask@gmail.com 9994549910
6.	Dr.S.Prabhu	Power Electronics and Drives	10	Associate Professor, Department of EEE, SreeVidyanikethan Engineering College SreeSainath Nagar, Tirupati.	prabhutajmahal6@gmail.com 9600646211

7.	Dr.R.Natarajan	Power Electronics and Drives	10	Associate Professor / EEE Fatima Michael College of Engineering and Technology, Madurai	natarajanrajavel369@gmail.com 9655986026
8.	Dr.A.Ragavendiran	Power system and control	11	Asst.Professor, Department of EEE, AVC College of Engineering, MannampandalMayiladudurai	ragavendiran.as@gmail.com 8248781797
9.	Dr.S.Senthikumar	Electrical Engineering	25	Associate Professor / EEE University College of Engineering, Ariyalur.	senthil21575@gmail.com 7810062427
10.	Dr.R.Karthikeyan	Power System	12	Asst.Professor, Department of EEE, University college of Engineering, Pattukottai.	kar_thamarai82@yahoo.com 9047656765
11.	Dr.V.VasanPrabhu	Power Electronics and Drives	11	Assistant Professor / Department of Automotive Electronics, SRM Institute of Science and Technology, Chennai.	vasanprv@srmist.edu.in 7358682007
12.	Dr.C. Kumar	Power Electronics and Drives	14	Professor M Kumarasamy college of engineering, Thalavapalayam, Tamil Nadu 639113	ckumarme81@gmail.com 9994942022
13.	Dr. S. Karthick	Image Processing	19	Associate Professor Erode Sengunthar Engineering College Thudupathi Post, Perundurai Erode – 638 057	resumekarthick@gmail.com 9486937253
14.	Mr.C.Nandakumar	Power Electronics and Drives	10	Assistant Professor, Arunai Engineering College, Velu Nagar, Mathur, Tiruvannamalai-606603 Tamilnadu.	nandha30electra@gmail.com 9865714571
15.	Dr.A.Venkadesan,	Electrical Drives and control	7	Assistant Professor National Institute of Technology , NH32, Karaikal, Puducherry 609609	venkadesan@nitpy.ac.in 7598566739

16.	Dr.S.Priyadharashni,	Power electronics & Drives	10	Assistant Professor Arunai Engineering College, Velu Nagar, Mathur, Tiruvannamalai-606603 Tamilnadu. INDIA.	priyamshanmugam@gmail.com 9994576791
17.	Dr.ArulMurugan	Power System	10	Professor & Head / EEE Excel Group of Institutions Erode, Tamil-Nadu	arulpvp@gmail.com 9842909393
18.	Dr. R .Gunabalan	Electrical Drives and Control	17	Associate Professor School of Electrical Engineering, VIT,Vandalur-Kelambakkam Road, Chennai-600 127	gunabalan.r@vit.ac.in 9894919269
19.	Dr.Padmaja Sankala	Power Electronics and Drives	12	Asst. Professor All India ShriShivaji memorial Society's College of Engineeirng,Pune	pksankala@aissmscoe.com 9923669024
20.	Dr.T.Venishkunmar	VLSI	10	Associate Professor Sethu Institute of Technology, Pulloor, Kariapatti – 626 115, Virudhunagar – Tamilnadu	tvenishkumar@gmail.com 9095577477
21.	Dr.R.Thamaraiselvi	Power Electronics and Drives	12	Assistant Professor/EEE University College of Engineering, Villupuram	r.thamaraiselvi1@gmail.com 9487363388
22.	Dr.R.Murugesan	Power Electronics and Energy systems	14	Asst.Professor, Department of EEE, Annamacharya Institute of Technology and Sciences Thirupati	rmurugesandr@gmail.com 9944228455
23.	Dr.T Suresh Padmanabhan	Power Electronics and Drives	17	Associate Professor, Department of ECE, E.G.S Pillay Engineering College,Nagapattinam.	drtsp@egspec.org 9444025552
24.	Dr.P.SathishBabu	Power System	12	Asst.Professor, Department of EEE, University college of Engineering, Panruti	psathishbabu@yahoo.co.in 8667313405

25.	Dr.V.Arun	Power system	11	Associate Professor, Department of EEE, SreeVidyanikethan Engineering College SreeSainath Nagar, Tirupati.	arunphd1986@gmail.com 8667244175
26.	Dr.S.Durai	Power System	11	Assistant Professor, Department of EEE, Annamalai University Deputed toLecturer Department of Electrical Engineering 126 – Government polytechnic college, Kottur, Theni	abcddurai@gmail.com 8667264066
27.	Dr.S.Karthikeyan	Power System	13	Assistant Professor Department of EEE, Annamalai University Deputed toLecturer Department of Electrical Engineering 126 – Government polytechnic college, Kottur, Theni	karthikaueee79@gmail.com 8825793371
28.	Dr.P.Velmurugan	Power Electronics and drives	10	Associate Professor, Department of EEE, St.Joseph's College of Engineering, Chennai	velupriya10@gmail.com 9976949243
29.	Dr.M.Sathya	Power system	16	Assistant Professor, Department of EEE, Government college of Engineering,Srirangam,Trichy	mrsathyaa@gces.edu.in 7010271378
30.	Dr.G.Ganesan @ Subramanian	Power Electronics and Drives	17	Associate Professor/EEE EGS Pillai Engineering College,Nagapattinam	ganesan@egspec.org956671 9011
31.	Dr.T.S.Balaji Damodhar	Power Electronics and Drives	16	Associate Professor / EEE, Ranipettai Engineering College, Walajah, Vellore	balajidamodhar@gmail.com 9944665102
32.	Dr.C.Kannan	Power Electronics	12	Associate Professor / EEE, Arunai Engineering College, Thiruvannamalai.	kannanc305@gmail.com 9841005438

33.	Dr.K.Sedhuraman	Power Electronics and Drives	8	Associate Professor / EEE, Manakula Vinayagar Institute of Technology, Kalitheerthalkuppam, Puducherry.	sedhuramaneee@mvit.edu.in 9092882883
34.	Mr.S.Rajkumar	Power Electronics and Drives	11	Assistant Professor / EEE, Manakula Vinayagar Institute of Technology, Kalitheerthalkuppam, Puducherry.	rajkumareee@mvit.edu.in 9952628247
35.	Mr.M.Saravanakumar	Power Electronics and Drives	12	Assistant Professor / EEE, Mailam Engineering College, Mailam	saravanakumareee@mailamengg.com 9786863566
36.	Mr.G.G.Muthukumar	Power Electronics and Drives	12	Assistant Professor / EEE, Mailam Engineering College, Mailam	muthukumareee@mailamengg.com 9894762505
37.	Dr.S.Satthiyaraj,Ph.D.,	Power Electronics and Drives	12	Asso.Prof/EEE, University College of Engineering, Panruti	satthiya@gmail.com 9500405949
38.	Dr.V.Krishnakumar	Electrical Drives and control	11	Asso.Prof./EEE/St.Joseph college of Engineering	v.krishnakumarjce@gmail.com 9944235136
39.	Dr. N. Arunkumar	Power Electronics and Drives	13	Asso.Prof/EEE Dhanalakshmi Srinivasan EngineeringCollege, Perambalur	narunme26@gmail.com 9894949670
40.	Mr.A.Vinothkumar	Power Electronics and Drives	10	AP/EEE, SRI College of Engineering and Technology, Vandavasi.	vinothkumareee91@gmail.com 6379224893
41.	Dr. R. Suresh	Power system	15	Associate Professor / SKP Engineering College , Thiruvannamalai	rsureshskp@gmail.com 9943863622