HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Curriculum and ODD Semesters Syllabus for the Batch

2024 – 2028 (R2022)

2023 – 2027 (R2022)

2022 – 2026 (R2022)

2021 – 2025 (R2019 with Amendments)

(Board of Studies held on 24.05.2024)

(Academic Council Meeting held on 21.06.2024)

S.No.	Particulars	Page Number(s)/ (From - To)
1.	Amendments under R 2022 & R2019 with Amendment (if any)	-
2.	Curriculum under R2022 (for the batch admitted during 2024 – 2025)	**5-19**
3.	First Semester Syllabus (for the batch admitted during 2024 – 2025)	**20-30**
4.	Details of Course Revisions & New Courses Introduced	**31**
5.	Curriculum under R2022 (for the batch admitted during 2023 – 2024)	**32-47**
6.	Third Semester Syllabus (for the batch admitted during 2023 – 2024)	**48-56**
7.	Details of Course Revisions & New Courses Introduced	**57**
8.	Curriculum under R2022 (for the batch admitted during 2022 – 2023)	**58-72**
9.	Fifth Semester Syllabus (for the batch admitted during 2022 – 2023)	**73-95**
10.	Details of Course Revisions & New Courses Introduced	**96**
11.	Curriculum under R2019 with Amendments (for the batch admitted during 2021 – 2022)	**97-105**
12.	Seventh Semester Syllabus (for the batch admitted during 2021 – 2022)	**106-116**
13.	Details of Course Revisions & New Courses Introduced	**117**
14.	Syllabus Offered for Minor Degree	**118-121**
15.	Syllabus Offered for Honour Degree	**122-127**
16.	Syllabus for Value Added Courses	-
17.	Percentage Revision & New Courses Introduced in the 9th BoS	**30.9%**

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY,
COIMBATORE 641 032
(An Autonomous Institution, Affiliated to Anna University, Chennai)

VISION AND MISSION OF THE INSTITUTION

VISION

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION

IM1: To provide academic excellence in technical education through novel teaching methods.

IM2: To empower students with creative skills and leadership qualities.

IM3: To produce dedicated professionals with social responsibility.

VISION AND MISSION OF THE DEPARTMENT

VISION

To manifest itself as a valuable global resource for industry and society with strong foundation. Abetting the students with innovative ethical and creative talents of endeavoring young professionals in Electrical and Electronics Engineering.

MISSION

M1: Educate the students to acquire knowledge in recent advancement of Electrical and Electronics Engineering and prepare the students for professional career and higher studies.

M2: Inculcate the students to develop innovation for the societal needs through research-oriented teaching and creative skill enhancement training.

M3: Enunciate the students with better skills to meet the challenges of the technical world and intensify the skills towards the practical approach.

Program Outcomes (POs):

Engineering Graduates will be able to:

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

The graduates will be able to:

PSO1: Graduates will acquire the knowledge of design, performance & testing of static & dynamic Electrical Machines, Electrical Drives, Power Electronics applicable in core and related fields.

PSO2: Graduates will attain knowledge and acquire skills by applying modern software tools for design, simulation and analysis of Electrical Systems to successfully adapt in multi-disciplinary environments.

Program Educational Objectives (PEO)

PEO 1: Graduate will be able to execute the principles of basic science, mathematics and engineering fundamentals necessary to formulate, solve and analyze engineering problems.

PEO 2: Graduate will be able to accrete the knowledge for pursuing advanced degrees in Engineering, Science, Management, Research and Development.

PEO 3: Graduate will be able to effectuate professionalism, leadership qualities, self and continuous learning and concern for environment to meet the societal needs.

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A+' Grade)

Coimbatore-641032.

B.E ELECTRICAL AND ELCTRONICS ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the ODD semester

Academic year 2024-2025

Batch 2024-2025

CURRICULUM
R2022

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (UG)

REGULATION-2022

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
		THEORY									
1.	22MA1101	Matrices and Calculus	BSC1	3	1	0	4	4	40	60	100
2.	22EE1201	Fundamentals of Electrical Science	ESC 1	3	0	0	3	4	40	60	100
		THEORY WITH LAB COMPONENT									
3.	22HE1151	English for Engineers	HSC1	2	0	2	3	4	50	50	100
4.	22CY1153	Chemistry for Electrical Sciences	BSC2	2	0	2	3	4	50	50	100
5.	22CS1151	Problem Solving using C Programming	ESC2	2	0	2	3	4	50	50	100
		EEC COURSES (SE/AE)									
6.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
7.	22HE1073	Introduction to Soft skills	SEC	2	0	0	0	1	100	0	100
		MANDATORY COURSE									
8.	22MC1093/ 22MC1094	தமிழர்மரபு / Heritage of Tamil	MC	2	0	0	1	2	40	60	100
9.	22MC1095	Universal Human Values	MC	2	0	0	0	2	100	0	100
			TOTAL	**15**	**1**	**10**	**18**	**26**	**570**	**330**	**900**

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
		THEORY									
1.	22MA2102	Differential Equations and Laplace Transforms	BSC3	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies	ESC3	2	0	0	2	3	40	60	100
3.	22EE2201	Basics of Electrical Engineering	PCC	3	0	0	3	3	40	60	100
4.	22EE2202	Solid State Devices	BSC4	2	0	0	2	3	40	60	100

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

THEORY WITH LAB COMPONENT											
5.	22HE2151	Effective Technical Communication	HSC2	2	0	2	3	4	50	50	100
6.	22PH2151	Physics For Engineers	BSC5	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking(Common to all)	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills and Aptitude	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2094/ 22MC2095	தமிழரும் தொழில்நுட்பமும்/ **TAMILS AND TECHNOLOGY**	MC	2	0	0	1	2	40	60	100
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							-
			TOTAL	**19**	**1**	**8**	**23**	**28**	**560**	**440**	**1000**

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA3102	Complex Analysis and Transforms	BSC	3	1	0	4	4	40	60	100
2.	22EE3201	Electronic Devices and Circuits	PCC	3	0	0	3	3	40	60	100
3.	22EE3202	Electric Circuit Analysis	PCC	3	1	0	4	4	40	60	100
4.	22EE3203	Field Theory	PCC	3	0	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
5.	22EI3251	Digital Electronics	ESC	2	1	2	4	4	50	50	100
PRACTICAL											
6.	22EE3001	Electric Circuits Laboratory	ESC	0	0	4	2	4	60	40	100
7.	22EE3002	Electronic Devices andCircuits Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE3071	Soft Skills and Aptitude - II	SEC	1	0	0	1	1	100	0	100
9.	22HE3072	Fundamentals of JAVA Programming	AEC	2	0	0	2	2	100	0	100
MANDATORY COURSE											
10	22MC3191	Essentials of Indian Traditional Knowledge	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**3**	**10**	**25**	**30**	**470**	**430**	**900**

ACADEMIC COUNCIL * HOD * HINDUSTHAN COLLEGE OF ENGG & TECH Chairman

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22EE4201	Electrical Machines -I	PCC	3	0	0	3	3	40	60	100
3.	22EE4202	Integrated Circuits and Its Applications	PCC	3	1	0	4	4	40	60	100
4.	22EE4203	Transmission and Distribution	PCC	3	0	0	3	3	40	60	100
5.	22EE4204	Power Plant Engineering	PCC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6.	22EI4251	Electrical and Electronic Measurements	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22EE4001	Electrical Machines- I Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22EE4002	Integrated Circuits Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
10.	22EE4701	Internship - I*	SEC4	-	-	-	1		100	0	100
			TOTAL	**17**	**1**	**10**	**24**	**28**	**570**	**430**	**1000**

* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same willbe evaluated in Semester IV.
If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE5201	Electrical Machines -II	PCC13	3	0	0	3	3	40	60	100
2.	22EE5202	Microprocessors and Microcontrollers	PCC14	3	0	0	3	3	40	60	100
3.	22EE53XX	Professional Elective-1	PEC1	3	0	0	3	3	40	60	100
4.	22EE53XX	Professional Elective-2	PEC2	3	0	0	3	3	40	60	100
5.	22EE53XX	Professional Elective-3	PEC3	3	0	0	3	3	40	60	100
THEORY WITHLABCOMPONENT											
6.	22EI5251	Control Systems	PCC15	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22EE5001	Electrical Machines –II Laboratory	PCC16	0	0	4	1.5	3	60	40	100
8.	22EE5002	Microprocessors and Microcontrollers Laboratory	PCC16	0	0	4	1.5	3	60	40	100
EEC COURSES (SE/AE)											
9.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	**18**	**0**	**10**	**22**	**26**	**470**	**430**	**900**

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE6201	Power Electronics	PCC17	3	0	0	3	3	40	60	100
2.	22EE6202	Power System Analysis	PCC18	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics	HSC6	3	0	0	3	3	40	60	100
4.	22EE63XX	Professional Elective-4	PEC4	3	0	0	3	3	40	60	100
5.	22EE63XX	Professional Elective-5	PEC5	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC1	3	0	0	3	3	40	60	100
7.	22XX64XX	Open Elective – 2*	OEC1	3	0	0	3	3	40	60	100
PRACTICAL											
8.	22EE6001	Power Electronics Laboratory	PCC 19	0	0	3	1	3	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**23**	**0**	**3**	**24**	**26**	**440**	**460**	**900**

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE7201	Protection and Switchgears	PCC20	3	0	0	3	3	40	60	100
2.	22EE73XX	Professional Elective-6	PEC6	3	0	0	3	3	40	60	100
3.	22XX7401	Open Elective – 3*	OEC3	3	0	0	3	3	40	60	100
4.	22LS74XX	Open Elective – 4*	OEC4	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22EE7201	Solid State Drives	PCC21	2	0	2	3	4	40	60	100
PRACTICAL											
6.	22EE7001	Power System Simulation Laboratory	PCC22	0	0	4	1.5	3	60	40	100
7.	22EE7002	Circuit Design Laboratory	PCC22	0	0	4	1.5	3	60	40	100
EEC COURSES (SE/AE)											
8.	22EE7701	Internship Training	SEC8	-	-	-	1	1	100	0	100
			TOTAL	**14**	**0**	**10**	**19**	**23**	**420**	**380**	**800**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22EE8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
				0	**0**	**20**	**10**	**20**	**100**	**100**	**200**

Note: * 1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.

2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2021 – 22

OPEN ELECTIVE I AND II (EMERGINGTECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6401	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6401	Cyber security	OEC	2	0	2	4	3
4	22EC6402	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6401	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6401	Augmented and Virtual Reality	OEC	2	0	2	4	3

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	OURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	**22EE6401**	Digital Marketing	OEC	3	0	0	3	3
13	**22EE6402**	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its Applications	OEC	3	0	0	3	3
2	22EE7402	Electric Vehicles	OEC	3	0	0	3	3

OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Power Engineering	Vertical II Machines and Converter Drives	Vertical III Embedded Systems	Vertical IV Electric Vehicle Technology	Vertical V Advanced Control	Vertical VI (Diversified Courses)
22EE5301 Flexible AC Transmission Systems	22EE5304 Design of Electrical Machines	22EE5307 Embedded System	22EE5310 Electric Vehicle Architecture	22EE5313 Process Modeling and Simulation	22EE5316 Energy Storage Systems
22EE5302 High Voltage Engineering	22EE5305 Special Electrical Machines	22EE5308 Microcontroller Based System Design	22EE5311 Automotive Electronics	22EE5314 Computer Control of Processes	22EE5317 Hybrid Energy Technology
22EE5303 Smart Grid	22EE5306 Power Semiconductor Devices	22EE5309 Software for Embedded Systems	22EE5312 Design of Motor and Power Converters for Electric Vehicles	22EE5315 Model Based Control	22EE5318 Design and Modelling of Renewable Energy Systems
22EE6301 Power System Operation and Control	22EE6303 Utilization and Conservation of Electrical Energy	22EE6305 Internet of Things	22EE6307 Design of Electric Vehicle Charging System	22EE6309 Non Linear Control	22EE6311 Sustainable and Environmental Friendly HV Insulation System
22EE6302 High Voltage Direct Current Transmission	22EE6304 SMPS and UPS	22EE6306 Embedded Control for Electric Drives	22EE6308 Electric Vehicle Design, Mechanics and Control	22EE6310 Optimal Control	22EE6312 Power System Transients
22EE7301 Power Quality	22EE7302 Power Electronics for Renewable Energy Systems	22EE7303 Embedded System for Automotive Applications	22EE7304 Testing of Electric Vehicles	22EE7305 Adaptive Control	22EE7306 PLC Programming

Note: *Students are permitted to choose all professional electives from any of the verticals.*

PROFESSIONAL ELECTIVE COURSES: VERTICALS

DETAILS OF VERTICAL I: Power Engineering

SL.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5301	High Voltage Direct Current Transmission	PEC	3	0	0	3	3
2.	22EE5302	High Voltage Engineering	PEC	3	0	0	3	3
3.	22EE5303	Power Quality	PEC	3	0	0	3	3
4.	22EE6301	Power System Operation and Control	PEC	3	0	0	3	3
5.	22EE6302	Flexible AC Transmission Systems	PEC	3	0	0	3	3
6.	22EE7301	Energy Management and Auditing	PEC	3	0	0	3	3

DETAILS OF VERTICAL II: Machines and Converter Drives

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5304	Design of Electrical Machines	PEC	3	0	0	3	3
2.	22EE5305	Special Electrical Machines	PEC	3	0	0	3	3
3.	22EE5306	Power Semiconductor Devices	PEC	3	0	0	3	3
4.	22EE6303	Power Electronics for Renewable Energy Systems	PEC	3	0	0	3	3
5.	22EE6304	SMPS and UPS	PEC	3	0	0	3	3
6.	22EE7302	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3

DETAILS OF VERTICAL III: Embedded Systems

SL.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5307	Embedded System	PEC	3	0	0	3	3
2.	22EE5308	Microcontroller Based System Design	PEC	3	0	0	3	3
3.	22EE5309	Software for Embedded Systems	PEC	3	0	0	3	3
4.	22EE6305	Internet of Things	PEC	3	0	0	3	3
5.	22EE6306	Embedded Control for Electric Drives	PEC	3	0	0	3	3
6.	22EE7303	Embedded System for Automotive Applications	PEC	3	0	0	3	3

DETAILS OF VERTICAL IV: Electric Vehicle Technology

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5310	Electric Vehicle Architecture	PEC	3	0	0	3	3
2.	22EE5311	Automotive Electronics	PEC	3	0	0	3	3
3.	22EE5312	Design of Motor and Power Converters for Electric Vehicles	PEC	3	0	0	3	3
4.	22EE6307	Design of Electric Vehicle Charging System	PEC	3	0	0	3	3
5.	22EE6308	Electric Vehicle Design,Mechanics and Control	PEC	3	0	0	3	3
6.	22EE7304	Testing of Electric Vehicles	PEC	3	0	0	3	3

DETAILS OF VERTICAL V: Advanced Control

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5313	Process Modeling and Simulation	PEC	3	0	0	3	3
2.	22EE5314	Computer Control of Processes	PEC	3	0	0	3	3
3.	22EE5315	Model Based Control	PEC	3	0	0	3	3
4.	22EE6309	Non Linear Control	PEC	3	0	0	3	3
5.	22EE6310	Optimal Control	PEC	3	0	0	3	3
6.	22EE7305	Adaptive Control	PEC	3	0	0	3	3

DETAILS OF VERTICAL VI: (Diversified Courses)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5316	Energy Storage Systems	PEC	3	0	0	3	3
2.	22EE5317	Hybrid Energy Technology	PEC	3	0	0	3	3
3.	22EE5318	Design and Modelling of Renewable Energy Systems	PEC	3	0	0	3	3
4.	22EE6311	Sustainable and Environmental Friendly HV Insulation System	PEC	3	0	0	3	3
5.	22EE6312	Power System Transients	PEC	3	0	0	3	3
6.	22EE7306	PLC Programming	PEC	3	0	0	3	3

Enrolment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree(Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree –

ELECTRICAL AND ELECTRONICS ENGINEERING OFFERING MINOR DEGREE: RENEWABLE ENERGY ENGINEERING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22EE5601	Sem 5:Introduction to Energy Studies	MDC	3	0	0	3	3
2.	22EE6601	Sem 6:Power plant Engineering	MDC	3	0	0	3	3
3.	22EE6602	Sem 6:Solar photovoltaic Fundamentals and Its Applications	MDC	3	0	0	3	3
4.	22EE7601	Sem 7:Wind Energy Conversion System	MDC	3	0	0	3	3
5.	22EE7602	Sem 7:Energy Storage Systems	MDC	3	0	0	3	3
6.	22EE8601	Sem 8: Power plantInstrumentation	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5602	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Perweek			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III

Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0		3

B.E (Hons) Electrical and Electronics Engineering with Specialization in Energy engineering

S.no.	Course code	Course title	Category	Periods per week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22EE5206	Sem 5:Energy Management &Auditing	PC	2	0	2	3	4	40	60	100
2.	22EE6205	Sem 6: Advanced Power Plant Engineering	PC	2	0	2	3	4	40	60	100
3.	22EE6206	Sem 6: Instrumentation for Energy Systems	PC	3	0	0	3	3	40	60	100
4.	22EE7205	Sem 7:Solar Energy Technologies	PC	2	0	2	3	4	40	60	100
5.	22EE7206	Sem 7: Energy Conservation in Industry Utilities	PC	2	0	2	3	4	40	60	100
6.	22EE8202	Sem 8:Wind Energy ConversionSystem	PC	2	0	2	3	4	40	60	100

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	-	-	-	-	-	20
3	ESC	6	4	6	-	-	-	-	-	16
4	PCC	-	3	12	20	12	7	9	-	63
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	1	3	3	2	1	2	1	10	23
8	MCC	1	1							2
Total		18	23	25	24	22	24	19	10	165

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	18	23	25	24	22	24	19	10	165

Chairman-BoS

Chairman - BoS
EEE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	22MA1101	MATRICES AND CALCULUS (Common to all Branches)	3	1	0	4

Course Objective

The learner should be able to

1. Construct the characteristic polynomial of a matrix and use it to identify Eigen values and Eigenvectors
2. Impart the knowledge of single variate calculus.
3. Familiarize the student with functions of several variables.
4. Acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
5. Make a vector differential operator for vector function and theorems to solve engineering problems

Unit	Description	Instructional Hours
I	**Matrices** Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**Single Variate Calculus** Rolle's Theorem – Lagrange's Mean Value Theorem - Maxima and Minima – Taylor's and Maclaurin's Series.	12
III	**Functions of Several Variables** Partial derivatives - Total derivative - Jacobians – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.	12
IV	**Integral Calculus** Double integrals in Cartesian coordinates – Area enclosed by plane curves (excluding surface area) – Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates.	12
V	**Vector Calculus** Gradient, divergence and curl vectors - Green's theorem - Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
	Total Instructional Hours	60

Course Outcome

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

CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.
CO3: Able to use differential calculus ideas on several variable functions.
CO4: Apply multiple integral ideas in solving areas, volumes and other practical problems.
CO5: Apply the concept of vector calculus in two and three-dimensional spaces.

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th edition, 2019.
T2 - K. P. Uma and S. Padma, "Engineering Mathematics I (Matrices and Calculus) ", Pearson Ltd,2022.

REFERENCE BOOKS:

R1 - Jerrold E. Marsden, Anthony Tromba, "Vector Calculus", W.H.Freeman, 2003-Strauss M. J, G. L Bradley and K. J .Smith, "Multivariable calculus", 6th edition, Prentice Hall, 2011.
R2 - Veerarajan T, "Engineering Mathematics", 5th edition, Mc Graw Hill Education(India) Pvt Ltd, New Delhi, 2016.
R3 - G. B. Thomas and R. L. Finney, "Calculus and Analytical Geometry", 9th Edition, Addison Wesley Publishing Company, 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	-	-	1	2	2		
CO2	3	3	3	3	2	2	2	-	-	1	2	2		
CO3	3	3	3	3	2	2	2	-	-	1	2	2		
CO4	3	3	3	3	2	2	2	-	-	1	2	2		
CO5	3	3	3	3	2	2	2	-	-	1	2	2		
AVG	3	3	3	3	2.2	2	2			1	2	2		

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / I	22EE1201	**Fundamentals of Electrical Science**	3	0	0	3

Course Objective

The student should be able to

1. Introduce the operation of various household electrical appliances.
2. Familiarize the principles and guidelines for residential building electrification.
3. Impart knowledge about electrical fundamentals, safety measures, and earthing techniques for electrical systems.
4. Provide an overview of electrical energy.
5. Explain the concepts of tariff calculation, and energy conservation principles.

Unit	Description	Instructional Hours
I	**HOUSE HOLD ELECTRICAL APPLIANCES** Basics of Voltage ,Current , Power –Introduction to Single and Three Phase Supply -Principles of working, of Electric fan– Electric Iron box– Water heater- Induction heater– Microwave oven– Motors used in washing machine and Wet grinder and Refrigerator	9
II	**RESIDENTIAL BUILDING ELECTRIFICATION** General rules guidelines for wiring of residential installation and positioning of equipment's - Principles of circuit design in lighting and power circuits - Procedures for designing the circuits and deciding the number of circuits - Selection of type of wiring and rating of wires and cables - Load calculations and selection of size of conductor - Earthing of residential Installation.	9
III	**BASICS OF ELECTRICAL SAFETY AND EARTHING** Overview of Electrical Hazards – importance of electrical safety – Factors affecting severity of shock – Significance of Earthing – Types and Components of Earthing system.	9
IV	**INTRODUCTION TO ELECTRICAL ENERGY** Introduction- Type of Energy-SI Unit-Electrical Energy-Definition-Unit of electrical energy-Electrical accessories and its rating-Energy Conservation-Importance and Necessity	9
V	**ENERGY CALCULATION AND TARIFF** Introduction –Types of Electrical Load – Objectives of Tariff- characteristics of Tariff -Tariff of electricity–Types-Definition- Residential and industrial tariff and simple calculation(kwh) - Case study: Energy calculation for single phase residential appliances.	9
	Total Instructional Hours	45

Course Outcome

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

CO1: Understand the operation of various household electrical appliances.

CO2: Comprehend the principles and guidelines for residential building electrification.

CO3: Understand about the electrical fundamentals, safety measures, and earthing techniques for electrical systems.

CO4: Learn the basics and overview of Electrical Energy.

CO5: Utilize knowledge of electrical energy concepts and tariff calculation methods to assess energy usage and make informed decisions regarding residential energy consumption.

TEXT BOOKS:

T1 - K B Raina & K Battacharya, "Electrical Design Estimating and Costing", Khanna Publications, 2020

T2 - K.B. Bhatia, "Study of Electrical Appliances & Devices", Khanna Publications, 2024.

REFERENCE BOOKS:

R1 - Edward Hughes, " Electrical Technology,", Pearson Education.

R2 - K. A. P. Malvino, Electronic Principles, 7th Edition, Tata McGraw Hill, 2007

R3 - S K Bhattcharya, " Basic Electrical and Electronics Engineering", Pearson, 2012

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	2	2
CO2	2	1	-	-	-	-	-	-	-	-	-	2	2	2
CO3	2	1	-	-	-	-	-	-	-	-	-	2	2	2
CO4	2	1	-	-	-	-	-	-	-	-	-	2	3	2
CO5	3	1	-	-	-	-	-	-	-	-	-	2	3	2
Avg	2	1	-	-	-	-	-	-	-	-	-	2	3	2

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / I	22HE1151	ENGLISH FOR ENGINEERS (Common to all Branches)	2	0	2	3

The student should be able

Course Objective

1. To help the students of engineering and technology develop a strong base in the use of English.
2. To help learners use language effectively in professional writing.
3. To impart basic English grammar and essentials of important language skills
4. To impart knowledge about the importance of vocabulary and grammar
5. To develop the communication skills of the students in both formal and informal situations

Unit	Description	Instructional Hours
I	**Language Proficiency:** Parts of Speech, Degrees of Comparison, Abbreviation& Acronyms **Writing:** Process Description, Instructions. **Vocabulary** – Words on Environment. **Practical Component: Listening-** Watching Short Videos and answer the questions, **Speaking-** Self introduction , Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarizing of documentaries / podcasts / interviews **Reading-** Purpose of Reading - Churning & Assimilation, Interpreting Ideas - Interpreting Graphs in Technical Writing.	9
II	**Language Proficiency**: Types of Sentences, Framing Question, One Word Substitution **Writing:** Writing Checklist, Reading Comprehension. **Vocabulary–** Words on Entertainment. **Practical Component: Listening-**Comprehensions based on TED talks **Speaking-** Story Telling **Reading** - Skimming – Scanning – Reading: Scientific Texts	9
III	**Language Proficiency:** Tenses, Conditional Clause ('If' clause), Active and Passive voices, **Writing:** Formal letter (invitation, acceptance, decline, Congratulation) Cloze test. **Vocabulary** – Words on Tools. **Practical Component: Listening-**Listening pre-recorded English language learning programme **Speaking** - Just a minute **Reading-** Reading feature articles (from newspapers and magazines) -Reading to identify point of view and perspective (opinion pieces, editorials etc.)	9
IV	**Language Proficiency:** Subject Verb Concord, Articles, The Use of Prefixes and Suffixes **Writing:** Preparing Agenda &Minutes, Writing Recommendations. **Vocabulary–** Words on Engineering process. **Practical Component: Listening-**An interview with someone who works for recruitment personnel. **Speaking-**Presentation on a general topic. **Reading-** Reading Comprehension - Literary Texts.	9
V	**Language Proficiency:** Prepositions, Phrasal Verbs, Modal Auxiliaries, **Writing:** Letter to the Editor, Sequencing of Sentences **Vocabulary –**Words on Engineering material **Practical Component: Listening-** Listening- Comprehensions based on Nat Geo/Discovery channel videos **Speaking-** Preparing posters and presenting as a team. **Reading-** Biographies, Travelogues, Technical blogs.	9
	Total Instructional Hours	**45**

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

fter completion of the course the learner will be able

Course Outcome

CO1: Understand English and converse effectively.
CO2: Enable the students to write coherently and cohesively.
CO3: Enable the development of basic grammar to enhance language for a better communication
CO4: Use suitable vocabulary and grammar with confidence and express their ideas both in speech and writing.
CO5: Follow the etiquettes in formal and informal communication.

TEXT BOOKS:

T1- Raymond Murphy, "English Grammar in Use"-5thedition CambridgeUniversityPress, 2019.
T2-Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.

REFERENCE BOOKS:

R1- Kapoor A.N., Business Letters for Different Occasions, New Delhi: S. Chand & Co. Pvt. Ltd., 2012.
R2-RaymondMurphy, " English Grammar For ESL Learners - Premium Fourth Edition.
R3- McCarthy, Michael et.al (2011) English Vocabulary in Use – advanced, Cambridge University Press

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	-	3	2	1		
CO2	-	-	-	-	2	3	2	3	1	3	1	-		
CO3	-	-	-	3		2	-	2	2	3	2	2		
CO4	-	-	-	-	-	2	-	2	1	3	1	1		
CO5	-	-	-	2	-	-	-	2	3	3	3	1		
AVG	-	-	-	2.5	2	2.3	2	2.2	1.8	3	1.8	1.3		

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / I	22CY1153	CHEMISTRY FOR ELECTRICAL SCIENCES (EEE,ECE & E&I)	2	0	2	3

The learner should be able to

Course Objective

1. Acquire knowledge on the concepts of chemistry involved in display systems and conducting polymer materials.
2. Extend the knowledge on the concepts of purification of water.
3. Extend the knowledge on principles of electrochemistry and modern batteries
4. Enhance the fundamental knowledge on the mechanism of corrosion and its control.
5. Gain knowledge on the E-waste management methods.

Unit	Description	Instructional Hours
I	**Water Science** Impurities in Water, Hardness of Water and Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- -Softening Method - Ion-Exchange Method, Desalination of Brackish Water - Reverse Osmosis. **Estimation of hardness of water by EDTA.** **Determination of Dissolved Oxygen in sewage water by Winkler's method.** **Estimation of alkalinity of water sample by indicator method.**	9
II	**Polymers in Electronics** Conducting polymers – Definition – Properties – Applications - Synthesis, Properties and applications of Polyacetylene, Polyaniline, Poly-p-phenylene sulphide, Polypyrrole, Polythiophene. Biodegradable polymer: Preparation, Properties and applications of Poly Lactic acid (PLA).	9
III	**Electrochemical Cell and Energy Storage** Electrochemical cells - Single and Standard Electrode Potential - Nernst equation for single electrode potential. EMF series - Applications. Batteries - Components - Classification - Construction, working and applications of electric vehicle batteries - Lithium-ion battery, Nickel-Metal Hydride Batteries and Solar Cells. **Estimation of Ferrous iron by Potentiometry.**	9
IV	**Corrosion Science** Introduction, Chemical corrosion – Pilling Bedworth rule – electrochemical corrosion – theory and types of electrochemical corrosion - Galvanic corrosion, Differential aeration corrosion. Corrosion control – Sacrificial anode and impressed cathodic current methods - factors influencing the rate of corrosion.	9
V	**Electronic Waste Management** E-waste - Introduction - Definition – Sources - Effects of E-waste on environment and human health - need for E-waste management - Extraction Gold and copper from printed circuit boards (PCBs) - Disposal treatment methods of E-waste - recycling of E-waste. **Estimation of copper by EDTA method.**	9
	Total Instructional Hours	**45**

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

Course Outcome

CO1: Utilize the electronic materials for various applications.
CO2: Explain the basic properties of water and its usage in domestic and industrial purposes.
CO3: Develop knowledge on the basic principles of electrochemistry and applications of energy conversion and storage devices.
CO4: Develop knowledge and understand the causes of corrosion and methods for corrosion prevention and protection of materials.
CO5: Utilize the knowledge to handle the E-waste and reduce its impacts on environment.

TEXT BOOKS:

T1 - P. C. Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi, 17th edition, (2022).
T2 - O. G. Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCE BOOKS:

R1 - Shikha Agarwal "Engineering Chemistry -Fundamentals and Applications, Cambridge University Press, Delhi, 2019
R2 - S. S. Dara "A Text book of Engineering Chemistry" S. Chand& Co. Ltd., New Delhi (2018).

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2		
CO2	2	3	2	1	1	1	1	-	1	-	1	2		
CO3	2	2	2	2	1	1	1	-	1	-	1	2		
CO4	2	2	2	2	1	1	1	-	1	-	1	2		
CO5	2	3	2	-	-	-	3	-	-	-	-	-		
AVG	2	2.6	2.2	1.5	1	1	1.4	-	1	-	1	2		

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./I	22CS1151	PROBLEM SOLVING USING C PROGRAMMING (EEE, EIE, CSE, IT &CS)	2	0	2	3

Course Objective

The learner should be able

1. To develop simple algorithms for arithmetic and logical problems.
2. To understand and implement the fundamental concepts in a program
3. To enable how to implement conditional branching, iteration and recursion
4. To understand how to decompose a problem into functions and synthesize a complete program and to enable them to use arrays, pointers, strings and structures in solving problems.
5. To understand the use files to perform read and write operations.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPUTERS** Computer Systems – Computing Environments – Computer Language – Creating and Running programs – Computer Numbering System – Storing Integers and Real Numbers – Algorithms - Flowchart. **INTRODUCTION TO C LANGUAGE** Character set - C Tokens, Identifiers and Keywords - Constants, Variables - Data types – Text Input / Output – Operators - Expressions – Precedence and Associativity – Evaluating Expressions – Type Conversions.	9
II	Illustrative program: 1) Josh went to the market to buy N apples. He found two shops, shop A and B, where apples were being sold in lots. He can buy any number of the complete lot(s) but not loose apples. He is confused with the price and wants you to figure out the minimum cost to buy exactly N apples. Write an algorithm for Josh to calculate the minimum cost to buy exactly N apples. **Input Format:** • The first line of the input consists of an integer – N, representing the total number of apples that Josh wants to buy. • The second line consists of two space-separated positive integers – M1 and P1, representing the number of apples in a lot and the lot's price at shop A, respectively. • The third line consists of two space-separated positive integers-M2 and P2, representing the number of apples in a lot and lot's price at shop B, respectively. **Output Format:** Print a positive integer representing the minimum price at which Josh can buy the apples. 2) Chaman planned to choose a four-digit lucky number for his car. His lucky numbers are 3,5 and 7. Help him find the number, whose sum is divisible by 3 or 5 or 7. Provide a valid car number, fails to provide a valid input then display that number is not a valid car number. Note: The input other than 4 digit positive number[includes negative and 0] is considered as invalid.	9
III	DECISION MAKING, ARRAYS, STRINGS AND POINTERS Two-way selection – Multi-way selection – Concept of a Loop – Pre-test and Post-test Loops – Initialization and Updating – Controlled Loops – Other Statements Related to Looping – Looping Application - Arrays - Strings - Pointers – Pointer Applications – Processor Commands. Illustrative program: 1) You are playing an online game. In the game, a list of N numbers is given. The player has to arrange the numbers so that all the odd numbers of the list come after the even numbers. Write an algorithm to arrange the given list such that all the odd numbers of the list come after the even numbers. Input • The first line of the input consists of an integer number, representing the size of the list(N). • The second line of the input consists of N space-separated integers representing the values of the list Output Print N space-separated integers such that all the odd numbers of the list come after the even numbers 2) Given an integer matrix of size N x N. Traverse it in a spiral form. Input: The first line contains N, which represents the number of rows and columns of a matrix. The next N lines contain N values, each representing the values of the matrix. Output: A single line containing integers with space, representing the desired traversal. Constraints: $0 < N < 500$ 3) A digital machine generates binary data which consists of a string of 0s and 1s. A maximum signal M, in the data, consists of the maximum number of either 1s or 0s appearing consecutively in the data but M can't be at the beginning or end of the string. Design a way to find the length of the maximum signal. Input The first line of the input consists of an integer N, representing the length of the binary string. The second line consists of a string of length N consisting of characters 1s only. Output	9

Print an integer representing the length of the maximum signal.

4) Given a string S(input consisting) of '*' and '#'. The length of the string is variable. The task is to find the minimum number of '*' or '#' to make it a valid string. The string is considered valid if the number of '*' and '#' are equal. The '*' and '#' can be at any position in the string.

Note : The output will be a positive or negative integer based on number of '*' and '#' in the input string.

(*>#): positive integer

(#>*): negative integer

(#=*): 0

FUNCTIONS, STRUCTURES AND UNION

Designing Structured Programs – Functions in C – User defined functions – Inter-Function Communication – Standard Function – Passing Arrays to Functions – Passing Pointers to Function – Recursion – Passing an array to a function – typedef – Enumerated types - Structure – Union – Programming Application.

IV	Illustrative program: 1) The Caesar cipher is a type of substitution cipher in which each alphabet in the plaintext or messages is shifted by a number of places down the alphabet. For example, with a shift of 1, P would be replaced by Q, Q would become R, and so on. To pass an encrypted message from one person to another, it is first necessary that both parties have the 'Key' for the cipher, so that the sender may encrypt and the receiver may decrypt it. Key is the number of OFFSET to shift the cipher alphabet. Key can have basic shifts from 1 to 25 positions as there are 26 total alphabets. As we are designing custom Caesar Cipher, in addition to alphabets, we are considering numeric digits from 0 to 9. Digits can also be shifted by key places. For Example, if a given plain text contains any digit with values 5 and keyy =2, then 5 will be replaced by 7. "-"(minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT". Write a function CustomCaesarCipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output. Enter your PlainText: All the best Enter the Key: 1 The encrypted Text is: BmmuifCftu	9

BINARY INPUT / OUTPUT

V	Defining and Opening a file, closing a file - input/output operations on files - error handling during I/O operations - random access to files - Text versus Binary Streams – Standard Library Functions for Files – Converting File type. Illustrative program: 1) Write a C Program to merge contents of two files into a third file. 2) Write a program in C to delete a specific line from a file.	9
	Total Instructional Hours	**45**

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

Course Outcome

CO1: Develop simple algorithms for arithmetic and logical problems.

CO2: Test and execute the programs and correct syntax and logical errors

CO3: Implement conditional branching, iteration and recursion

CO4: Decompose a problem into functions and synthesize a complete program and use arrays, pointers, strings and structures to formulate algorithms and programs

CO5: Use files to perform read and write operations

TEXT BOOKS:

T1 - Behrouz A. Forouzan, Richard F. Gilberg, J. Jaya, S. Shankar, I. Jasmine Selvakumari Jeya, M. Ramya Devi, "Computer Programming in C", Cengage Learning, 2022.

T2 - Byron Gottfried, "Programming with C", Schaum's Outlines Series, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS:

R1 Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th edition, 2014.

R2 R. S. Bichkar, "Programming with C", Universities Press, 2nd edition 2012.

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	3	2	0	0	0	3	0	3	0	3	3
CO2	2	2	2	2	2	3	0	1	2	0	3	2	3	2
CO3	3	2	1	2	2	3	0	1	2	0	2	2	2	2
CO4	3	1	2	2	0	3	0	1	0	0	2	2	2	1
CO5	3	1	2	1	2	0	0	0	0	0	2	3	2	2
AVG	2	2.6	2.2	1.5	1.7	2	0	1	1	0	2.2.	2.1	2.4	1.9

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/I	22HE1072	ENTREPRENEURESHIP AND INNOVATION (Common to all Branches)	1	0	0	1

Course Objective

The student should be made

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5. To make students understand organizational performance and its importance

Unit	Description
1	**Entrepreneurial Thinking**
2	**Innovation Management**
3	**Design Thinking**
4	**Opportunity Spotting / Opportunity Evaluation**
5	**Industry and Market Research**
6	**Innovation Strategy and Business Models**
7	**Financial Forecasting**
8	**Business Plans/ Business Model Canvas**
9	**Entrepreneurial Finance**
10	**Pitching to Resources Providers / Pitch Deck**
11	**Negotiating Deals**
12	**New Venture Creation**
13	**Lean Start-ups**
14	**Entrepreneurial Ecosystem**
15	**Velocity Venture**

Total Instructional Hours 15

Course Outcome

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

CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3: Remember effectively and efficiently the potential of new business opportunities.
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
CO5: Develop a business model for a new venture, including revenue. Margins, operations, Working capital and investment.

TEXT BOOKS:

T1:Arya Kumar"Entrepreneurship–CreatingandleadinganEntrepreneurialOrganization",Pearson,SecondEdition(2012).
T2: EmrahYayici"DesignThinkingMethodology", Artbiztech, FirstEdition(2016).

REFERENCE BOOKS:

R1: Christopher Golis "Enterprise & Venture Capital", Allen &Unwin Publication, Fourth Edition (2007).
R2: Thomas Lock Wood & Edger Papke"Innovation by Design",Career Press.com,Second Edition(2017).
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition(2010).

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	2
AVG	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * TECH * HINDUSTHAN COLLEGE OF ENGG * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Semester	Course Code	Course Title	L	T	P	C
B.E./B.Tech/I	22HE1073	INTRODUCTION TO SOFT SKILLS	2	0	0	0

Course Objectives:

1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
2. To enhance the students ability to deal with numerical and quantitative skills.
3. To identify the core skills associated with critical thinking.
4. To develop and integrate the use of English language skills.

Unit	Description	Instructional Hours
I	**Lessons on excellence** Skill introspection, Skill acquisition, consistent practice	2
II	**Logical Reasoning** Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	**Quantitative Aptitude** Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	**Recruitment Essentials** Resume Building - Impression Management	2
V	**Verbal Ability** Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement – Punctuations	4
	Total Instructional Hours	30

Course Outcome

CO1	Students will analyze interpersonal communication skills. public speaking skills.
CO2	Students will exemplify tautology, contradiction and contingency by logical thinking.
CO3	Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4	Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
CO5	Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar.

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E/ I	22MC1093	தமிழர்மரபு	2	0	0	1

Unit	Description	Instructional Hours
I	**அலகு I மொழி மற்றும் இலக்கியம்** 3 இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன ஆகியோரின் பங்களிப்பு.	3
II	**அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை** 3 நடுகல் முதல் நவீன சிறபங்கள் வரை – ஐம்பொன சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிறபங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	3
III	**அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** 3 தெருக்கூத்து, காரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம் தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	3
IV	**அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்** 3 தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.	3
V	**அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு** 3 இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.	3
	Total Instructional Hours	15

TEXT CUM REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3						2					2
CO2	2	3	3						2					2
CO3	2	3	3						2					2
CO4	2	3	-						2					2
CO5	2	3	-						2					2
AVG	2	3	1.8						2					2

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * MADHAVARAM COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Semester	Course Code	Name of the Course	L	T	P	C
B.E./ I	22MC1094	HERITAGE OF TAMIL (Common to all Branches)	2	0	0	1

The learner should be able to

Course Objective

1. Introduce students to the great History of Tamil literature.
2. Establish the heritage of various forms of Rock art and Sculpture art.
3. To study and understand the various folk and Martial arts of Tamil culture
4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
I	**Language and Literature** Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _ Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II	**Heritage _ Rock Art Paintings to Modern Art – Sculpture** Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III	**Folk and Martial Arts** Therukoothu, Karagattem, Villupattu, Kaniyankoothu, Oyilattam, Leather puppertry, Silambattam..Valari Tiger dance – Sports and Games of Tamils.	6
IV	**Thinai Concept of Tamils** Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Exporot and Import during Sangam age – Overseas conquest of Cholas.	6
V	**Contribution of Tamils to Indian National Movement and Indian Culture** Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books.	6
	Total Instructional Hours	**30**

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

Course Outcome

CO1: Learn about the works pertaining to Sangam age
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
CO3Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.
CO5: Understand the contribution of Tamil Literature to Indian Culture

TEXT BOOKS:

T1- Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
T2- Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:International Institute of Tamil Studies.
T3- Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCE BOOKS:

R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu TextBookand Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL)

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academi...
HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / I	22MC1095	UNIVERSAL HUMAN VALUES (COMMON TO ALL BRANCHES)	2	0	0	0

Course Objective

The student should be made

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. TohighlightplausibleimplicationsofsuchaHolisticunderstandingIntermsofethicalhumanconduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
II	**Harmony in the Human Being and Harmony in the Family** Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	**Harmony in the Nature / Existence** Understanding Harmony in the Nature.Inter connectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasivespace Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
	Total Instructional Hours	**30**

Course Outcome

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

CO1: To become more aware of holistic vision of life - themselves and their surroundings.

CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.

CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.

CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions.

CO5: To develop competence and capabilities for maintaining Health and Hygiene..

REFERENCE BOOKS:

T1 - P. C. Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi, 17th edition, (2022).

T2 - O. G. Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

R1 - Shikha Agarwal "Engineering Chemistry -Fundamentals and Applications, Cambridge University Press, Delhi, 2019

R2 - S. S. Dara "A Text book of Engineering Chemistry" S. Chand& Co. Ltd., New Delhi (2018).

PO&PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	1	1	1	1	-	1	-	1	2		
CO2	2	3	2	1	1	1	1	-	1	-	1	2		
CO3	2	2	2	2	1	1	1	-	1	-	1	2		
CO4	2	2	2	2	1	1	1	-	1	-	1	2		
CO5	2	3	2	-	-	-	3	-	-	-	-	-		
AVG	2	2.6	2.2	1.5	1	1	1.4	-	1	-	1	2		

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

2022 Regulation – 2024 Batch I semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
				NIL		

New Course Introduced (2022 Regulation) – 2024 Batch I semester

S.No	Regulation	Course Code with Name	Credits
1.	2022	22EE1201- Fundamentals of Electrical Science	3

Chairman BoS
Chairman - BoS
EEE - HiCET

Dean Academics
Dean (Academics)
HiCET

Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A+' Grade)

Coimbatore-641032.

B.E ELECTRICAL AND ELCTRONICS ENGINEERING

HINDUSTHAN
EDUCATIONAL AND CHARITABLE TRUST
HICET

CHOICE BASED CREDIT SYSTEM

Revised Curriculum and Syllabus for the odd semester

Academic year 2024-25

Batch: 2023-2027

CURRICULUM R2022

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (UG)

REGULATION-2022

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA1101	Matrices and Calculus (common to all branches)	BSC1	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2.	22HE1151	English for Engineers (Common to all branches)	HSC1	2	0	2	3	4	50	50	100
3.	22CY1151	Chemistry for Circuit Engineering	BSC2	2	0	2	3	4	50	50	100
4.	22ME1201	Engineering Drawing	ESC 1	1	0	4	3	5	50	50	100
5.	22CS1151	Problem Solving using C Programming	ESC2	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6.	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
7.	22HE1073	Introduction to Soft skills	SEC	2	0	0	0	1	100	0	100
MANDATORY COURSE											
8.	22MC1093/ 22MC1094	தமிழர்மரபு / Heritage of Tamil	MC	2	0	0	1	2	40	60	100
9.	22MC1095	Universal Human Values	MC	2	0	0	0	2	100	0	100
			TOTAL	**17**	**1**	**10**	**18**	**27**	**580**	**320**	**900**

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA2102	Differential Equations and Laplace Transforms	BSC3	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies (Common all)	ESC3	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC4	2	0	0	2	3	40	60	100

4.	22EE2201	Basics of Electrical and Communication Engineering	PCC	3	0	0	3	3	50	50	100
THEORY WITH LAB COMPONENT											
5.	22HE2151	Effective Technical Communication (Common to all)	HSC2	2	0	2	3	4	50	50	100
6.	22PH2151	Physics For Circuit Engineering	BSC5	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22ME2001	Engineering Practices(Common to all)	ESC	0	0	4	2	2	60	40	100
EEC COURSES (SE/AE)											
8.	22HE2071	Design Thinking(Common to all)	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills -1(Common to all)	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
10.	22MC2094/ 22MC2095	தமிழரும் தொழில்நுட்பமும்/ TAMILS AND TECHNOLOGY	MC	2	0	0	1	2	40	60	100
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							-
			TOTAL	**19**	**1**	**8**	**23**	**27**	**570**	**430**	**1000**

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA3102	Complex Analysis and Transforms	BSC	3	1	0	4	4	40	60	100
2.	22EE3201	Electronic Devices and Circuits	PCC	3	0	0	3	3	40	60	100
3.	22EE3202	Electric Circuit Analysis	PCC	3	1	0	4	4	40	60	100
4.	22EE3203	Field Theory	PCC	3	0	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
5.	22EI3251	Digital Electronics	ESC	2	1	2	4	4	50	50	100
PRACTICAL											
6.	22EE3001	Electric Circuits Laboratory	ESC	0	0	4	2	4	60	40	100
7.	22EE3002	Electronic Devices and Circuits Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
8.	22HE3071	Soft Skills and Aptitude - II	SEC	1	0	0	1	1	100	0	100
9.	22HE3072	Fundamentals of JAVA Programming	AEC	2	0	0	2	2	100	0	100
MANDATORY COURSE											
10	22MC3191	Essentials of Indian Traditional Knowledge	MC	2	0	0	0	2	0	0	0
			TOTAL	**17**	**3**	**10**	**25**	**30**	**530**	**370**	**900**

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22EE4201	Electrical Machines -I	PCC	3	0	0	3	3	40	60	100
3.	22EE4202	Integrated Circuits and Its Applications	PCC	3	1	0	4	4	40	60	100
4.	22EE4203	Transmission and Distribution	PCC	3	0	0	3	3	40	60	100
5.	22EE4204	Power Plant Engineering	PCC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6.	22EI4251	Electrical and Electronic Measurements	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22EE4001	Electrical Machines- I Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22EE4002	Integrated Circuits Laboratory	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
10.	22EE4701	Internship - I*	SEC4	-	-	-	1		100	0	100
			TOTAL	**17**	**1**	**10**	**24**	**28**	**570**	**430**	**1000**

* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV.
If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE5201	Electrical Machines -II	PCC13	3	0	0	3	3	40	60	100
2.	22EE5202	Microprocessors and Microcontrollers	PCC14	3	0	0	3	3	40	60	100
3.	22EE53XX	Professional Elective-1	PEC1	3	0	0	3	3	40	60	100
4.	22EE53XX	Professional Elective-2	PEC2	3	0	0	3	3	40	60	100
5.	22EE53XX	Professional Elective-3	PEC3	3	0	0	3	3	40	60	100
THEORY WITHLABCOMPONENT											
6.	22EI5251	Control Systems	PCC15	2	0	2	3	4	50	50	100
PRACTICAL											
7.	22EE5001	Electrical Machines –II Laboratory	PCC16	0	0	4	1.5	3	60	40	100
8.	22EE5002	Microprocessors and Microcontrollers Laboratory	PCC16	0	0	4	1.5	3	60	40	100
EEC COURSES (SE/AE)											
9.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
			TOTAL	**18**	**0**	**10**	**22**	**26**	**470**	**430**	**900**

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE6201	Power Electronics	PCC17	3	0	0	3	3	40	60	100
2.	22EE6202	Power System Analysis	PCC18	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics	HSC6	3	0	0	3	3	40	60	100
4.	22EE63XX	Professional Elective-4	PEC4	3	0	0	3	3	40	60	100
5.	22EE63XX	Professional Elective-5	PEC5	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC1	3	0	0	3	3	40	60	100
7.	22XX64XX	Open Elective – 2*	OEC1	3	0	0	3	3	40	60	100
PRACTICAL											
8.	22EE6001	Power Electronics Laboratory	PCC 19	0	0	3	1	3	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**23**	**0**	**3**	**24**	**26**	**440**	**460**	**900**

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE7201	Protection and Switchgears	PCC20	3	0	0	3	3	40	60	100
2.	22EE73XX	Professional Elective-6	PEC6	3	0	0	3	3	40	60	100
3.	22XX7401	Open Elective – 3*	OEC3	3	0	0	3	3	40	60	100
4.	22LS74XX	Open Elective – 4*	OEC4	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22EE7201	Solid State Drives	PCC21	2	0	2	3	4	40	60	100
PRACTICAL											
6.	22EE7001	Power System Simulation Laboratory	PCC22	0	0	4	1.5	3	60	40	100
7.	22EE7002	Circuit Design Laboratory	PCC22	0	0	4	1.5	3	60	40	100
EEC COURSES (SE/AE)											
8.	22EE7701	Internship Training	SEC8	-	-	-	2	1	100	0	100
			TOTAL	**14**	**0**	**10**	**20**	**23**	**420**	**380**	**800**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22EE8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
			TOTAL	0	0	20	10	20	100	100	200

Note:

* 1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.

2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2021 – 22

OPEN ELECTIVE I AND II (EMERGINGTECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6401	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6401	Cyber security	OEC	2	0	2	4	3
4	22EC6402	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6401	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6401	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTAC TPERIOD S	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	**22EE6401**	Digital Marketing	OEC	3	0	0	3	3
13	**22EE6402**	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its Applications	OEC	3	0	0	3	3
2	22EE7402	Electric Vehicles	OEC	3	0	0	3	3

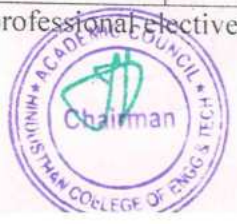
OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights. Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Power Engineering	**Vertical II Machines and Converter Drives**	**Vertical III Embedded Systems**	**Vertical IV Electric Vehicle Technology**	**Vertical V Advanced Control**	**Vertical VI (Diversified Courses)**
22EE5301 Flexible AC Transmission Systems	22EE5304 Design of Electrical Machines	22EE5307 Embedded System	22EE5310 Electric Vehicle Architecture	22EE5313 Process Modeling and Simulation	22EE5316 Energy Storage Systems
22EE5302 High Voltage Engineering	22EE5305 Special Electrical Machines	22EE5308 Microcontroller Based System Design	22EE5311 Automotive Electronics	22EE5314 Computer Control of Processes	22EE5317 Hybrid Energy Technology
22EE5303 Smart Grid	22EE5306 Power Semiconductor Devices	22EE5309 Software for Embedded Systems	22EE5312 Design of Motor and Power Converters for Electric Vehicles	22EE5315 Model Based Control	22EE5318 Design and Modelling of Renewable Energy Systems
22EE6301 Power System Operation and Control	22EE6303 Utilization and Conservation of Electrical Energy	22EE6305 Internet of Things	22EE6307 Design of Electric Vehicle Charging System	22EE6309 Non Linear Control	22EE6311 Sustainable and Environmental Friendly HV Insulation System
22EE6302 High Voltage Direct Current Transmission	22EE6304 SMPS and UPS	22EE6306 Embedded Control for Electric Drives	22EE6308 Electric Vehicle Design, Mechanics and Control	22EE6310 Optimal Control	22EE6312 Power System Transients
22EE7301 Power Quality	22EE7302 Power Electronics for Renewable Energy Systems	22EE7303 Embedded System for Automotive Applications	22EE7304 Testing of Electric Vehicles	22EE7305 Adaptive Control	22EE7306 PLC Programming

Note: Students are permitted to choose all professional electives from any of the verticals.



PROFESSIONAL ELECTIVE COURSES: VERTICALS

DETAILS OF VERTICAL I: Power Engineering

SL. NO.	COURSE C ODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5301	High Voltage Direct Current Transmission	PEC	3	0	0	3	3
2.	22EE5302	High Voltage Engineering	PEC	3	0	0	3	3
3.	22EE5303	Power Quality	PEC	3	0	0	3	3
4.	22EE6301	Power System Operation and Control	PEC	3	0	0	3	3
5.	22EE6302	Flexible AC Transmission Systems	PEC	3	0	0	3	3
6.	22EE7301	Energy Management and Auditing	PEC	3	0	0	3	3

DETAILS OF VERTICAL II: Machines and Converter Drives

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5304	Design of Electrical Machines	PEC	3	0	0	3	3
2.	22EE5305	Special Electrical Machines	PEC	3	0	0	3	3
3.	22EE5306	Power Semiconductor Devices	PEC	3	0	0	3	3
4.	22EE6303	Power Electronics for Renewable Energy Systems	PEC	3	0	0	3	3
5.	22EE6304	SMPS and UPS	PEC	3	0	0	3	3
6.	22EE7302	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3

DETAILS OF VERTICAL III: Embedded Systems

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5307	Embedded System	PEC	3	0	0	3	3
2.	22EE5308	Microcontroller Based System Design	PEC	3	0	0	3	3
3.	22EE5309	Software for Embedded Systems	PEC	3	0	0	3	3
4.	22EE6305	Internet of Things	PEC	3	0	0	3	3
5.	22EE6306	Embedded Control for Electric Drives	PEC	3	0	0	3	3
6.	22EE7303	Embedded System for Automotive Applications	PEC	3	0	0	3	3

DETAILS OF VERTICAL IV: Electric Vehicle Technology

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5310	Electric Vehicle Architecture	PEC	3	0	0	3	3
2.	22EE5311	Automotive Electronics	PEC	3	0	0	3	3
3.	22EE5312	Design of Motor and Power Converters for Electric Vehicles	PEC	3	0	0	3	3
4.	22EE6307	Design of Electric Vehicle Charging System	PEC	3	0	0	3	3
5.	22EE6308	Electric Vehicle Design, Mechanics and Control	PEC	3	0	0	3	3
6.	22EE7304	Testing of Electric Vehicles	PEC	3	0	0	3	3

DETAILS OF VERTICAL V: Advanced Control

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5313	Process Modeling and Simulation	PEC	3	0	0	3	3
2.	22EE5314	Computer Control of Processes	PEC	3	0	0	3	3
3.	22EE5315	Model Based Control	PEC	3	0	0	3	3
4.	22EE6309	Non Linear Control	PEC	3	0	0	3	3
5.	22EE6310	Optimal Control	PEC	3	0	0	3	3
6.	22EE7305	Adaptive Control	PEC	3	0	0	3	3

DETAILS OF VERTICAL VI: (Diversified Courses)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5316	Energy Storage Systems	PEC	3	0	0	3	3
2.	22EE5317	Hybrid Energy Technology	PEC	3	0	0	3	3
3.	22EE5318	Design and Modelling of Renewable Energy Systems	PEC	3	0	0	3	3
4.	22EE6311	Sustainable and Environmental Friendly HV Insulation System	PEC	3	0	0	3	3
5.	22EE6312	Power System Transients	PEC	3	0	0	3	3
6.	22EE7306	PLC Programming	PEC	3	0	0	3	3

Enrolment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree(Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree –

ELECTRICAL AND ELECTRONICS ENGINEERING OFFERING MINOR DEGREE: RENEWABLE ENERGY ENGINEERING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1.	22EE5601	Sem 5:Introduction to Energy Studies	MDC	3	0	0	3	3
2.	22EE6601	Sem 6:Power plant Engineering	MDC	3	0	0	3	3
3.	22EE6602	Sem 6:Solar photovoltaic Fundamentals and Its Applications	MDC	3	0	0	3	3
4.	22EE7601	Sem 7:Wind Energy Conversion System	MDC	3	0	0	3	3
5.	22EE7602	Sem 7:Energy Storage Systems	MDC	3	0	0	3	3
6.	22EE8601	Sem 8: Power plant Instrumentation	MDC	3	0	0	3	

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5602	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III

Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (Hons) Electrical and Electronics Engineering with Specialization in Energy engineering

S.NO.	COURSECODE	COURSETITLE	CATEGORY	PERIODS PERWEEK				TCP	CIA	ESE	TOTAL
				L	T	P	C				
1.	22EE5206	Sem 5:Energy Management & Auditing	PC	2	0	2	3	4	40	60	100
2.	22EE6205	Sem 6: Advanced Power Plant Engineering	PC	2	0	2	3	4	40	60	100
3.	22EE6206	Sem 6: Instrumentation for Energy Systems	PC	3	0	0	3	3	40	60	100
4.	22EE7205	Sem 7:Energy Conversion Techniques	PC	2	0	2	3	4	40	60	100
5.	22EE7206	Sem 7:Electric vehicle Machines and Drives	PC	2	0	2	3	4	40	60	100
6.	22EE8202	Sem 8:Wind Energy Conversion System	PC	2	0	2	3	4	40	60	100

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES									
S.No.	Course Area	Credits per Semester							Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	-	-	-	-	-	20
3	ESC	6	4	6	-	-	-	-	-	16
4	PCC	-	3	12	20	12	7	9	-	63
5	PEC	-	-	-	-	9	6	3	-	18
6	OEC	-	-	-	-	-	6	6	-	12
7	EEC	3	3	3	2	1	2	2	10	26
8	MCC	-	-	-	-	-	-	-	-	-
	Total	19	22	25	24	22	24	20	10	165

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	24	22	24	20	10	165

Chairman-BoS

Chairman - BoS
EEE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering & Techno...
COIMBATORE - 641 032.

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.E	22MA3102	COMPLEX ANALYSIS ANDTRANSFORMS (EEE, EIE, ECE)	3	1	0	4

Course Objective

The learner should be able to

1. Introduction to analytic functions and its properties.
2. Understand Cauchy's theorem and its applications in evaluation of integral.
3. Analyze Fourier series which is central to many applications in engineering
4. Apply Fourier transform techniques in various situations.
5. Analyze Z transform techniques for discrete time systems

Unit	Description	Instructional Hours
I	**COMPLEX DIFFERENTIATION** Functions of complex variables – Analytic functions – Cauchy's – Riemann equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
II	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem - Contour Integration with unit circle only.	12
III	**FOURIER SERIES** Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Change of Interval - Parseval's Identity - Half Range Sine and Cosine Series.-Harmonic analysis	12
IV	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier Sine and Cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval's identity (Statement only).	12
V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS** Z- Transforms - Elementary properties – Inverse Z - transform (using partialfraction and residues) – Convolution theorem(excluding proof)– Solution of difference equations using Z – transform	12
	Total Instructional Hours	**60**

Course Outcome

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

CO1: Understand the concept of analytic functions and discuss its properties.

CO2: Evaluate various integrals by using Cauchy's residue theorem and classify singularities andderive Laurent series expansion

CO3: Understand the principles of Fourier series which helps them to solve physical problems of Engineering

CO4: Apply Fourier transform techniques which extend its applications.

CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems

TEXT BOOKS:

T1 – Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2019.

T2 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1 - James Ward Brown, Ruel Vance Churchill, Complex Variables and Applications, McGraw-Hill HigherEducation, 2004

R2 - Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones & BartlettLearning, 2011

R3 - Ian N. Sneddon, Elements of Partial Differential Equations, Courier Corporation, 2013

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	1	-	-	1	2	2	3	2
CO2	3	3	3	3	3	-	1	-	-	1	2	2	3	2
CO3	3	3	3	3	2	-	1	-	-	1	2	2	3	2
CO4	3	3	3	2	2	-	1	-	-	1	2	2	2	2
CO5	3	3	3	2	2	-	1	-	-	1	3	2	2	2
AVG	3	3	3	2.6	2.4	-	1	-	-	1	2.2	2	2.6	2

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	CourseCode	Name of the course	L	T	P	C
BE	22EE3201	Electronic Devices and Circuits	3	0	0	3

Course Objectives

1. Recall the basics about the electronic devices.
2. Interpret the structure, operation and characteristics of transistors.
3. Analyze various configurations of BJT amplifiers.
4. Infer the basic concepts of large signal amplifiers.
5. Interpret the operations of feedback amplifiers and oscillators.

Unit	Description	Instructional Hours
I	**SEMICONDUCTOR DIODE** PN Junction Diode - Structure, Operation and V-I Characteristics, Ideal diode, Diode Current Equation, Application of Diode - Rectifiers: Half Wave and Full Wave Rectifier, with capacitive filters.	9
II	**TRANSISTORS** Junction transistor - BJT: CE, CB and CC configurations, Transistor Biasing Circuits - JFET: Output and Transfer Characteristics, Structure, Operation and Characteristics	9
III	**DESIGN AND ANALYSIS OF SMALL SIGNAL AMPLIFIER** BJT - Transistor Modeling, Hybrid Equivalent Circuit, Small Signal Analysis - Low Frequency Model: CE, CB, CC amplifiers.	9
IV	**LARGE SIGNAL AMPLIFIERS** Classification of Power Amplifiers, Efficiency of Class A Amplifier, Class B Complementary – Symmetry and Class C – operation.	9
V	**FEEDBACK AMPLIFIERS AND OSCILLATORS** Advantages of Negative Feedback - Voltage / Current, Series, Shunt Feedback - Positive Feedback - Condition for Oscillations, RC Phase Shift - Wien bridge, Hartley, Colpitts and Crystal Oscillators.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Apply the knowledge acquired about electronic devices.
- CO2 Summarize the concepts of transistors.
- CO3 Transform the acquired skill in designing a circuit.
- CO4 Illustrate the nature of large signal amplifiers.
- CO5 Outline the concepts of feedback amplifiers, conditions for oscillation and types of

TEXT BOOKS:

T1 David A. Bell, "Electronic Devices and Circuits", 5th Edition, Prentice Hall Publications, 2008.

T2 S.Salivahanan, "Electronic Devices and Circuits", 3rd Edition, Tata McGraw-Hill Education, 2012.

REFERENCE BOOKS:

R1 Rashid, "Microelectronic Circuits: Analysis & Design" 2nd Edition , CL Engineering publishers, 2010

R2 A P Godse, U A Bakshi, "Electronic Devices and Circuits", Technical Publications, 2017.

R3 Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2006.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3									2	3	2
CO2	3	2	3									2	3	2
CO3	3	3	3		2		2					3	2	2
CO4	3	3	3				1					3	2	3
CO5	3	3	3		2		1					3	2	3
AVG	3	3	3		2		1.333					2.6	2.4	2.4

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE	22EE3202	Electric Circuit Analysis	3	1	0	4

Common to EEE and EIE

Course Objective

1. Analyze electric circuits and solve complex circuits
2. Impart knowledge on various network theorems in AC and DC circuits
3. Provide knowledge on resonance phenomenon and analyze coupled circuits
4. Analyze transient response of AC and DC inputs to RL.RC and RLC circuits
5. Draw phasor diagrams of voltage and current for three phase circuits and measure power and power factor.

Unit	Description	Instructional Hours
I	**BASIC CIRCUITS ANALYSIS** Ohm's Law – Kirchoff's laws – DC and AC Circuits — Mesh current and Node voltage method - Energy stored in Capacitor and Inductor – Impedance and Admittance – Phasor Relationship for R, L and C - Phasor Diagram.	12
II	**NETWORK THEOREMS FOR DC AND AC CIRCUITS** Thevenin's and Norton Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem-Millman's Theorem.	12
III	**RESONANCE AND COUPLED CIRCUITS** Series and Parallel resonance –Variation of Capacitor Voltage and Inductor Voltage with Frequency - Self and mutual inductance – Coefficient of coupling – Dot rule for coupled circuits - Tuned circuits -Single tuned circuits.	12
IV	**TRANSIENT RESPONSE** Transient response of RL, RC and RLC Circuits using Laplace transform for DC input - Time constants - Transient response of A.C. circuits for single loop circuit.	12
V	**THREE PHASE CIRCUITS** Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected, balanced & unbalanced loads – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits using two wattmeter method.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Apply basic laws to electrical circuits.
CO2: Solve electrical circuits using network theorems
CO3: Explain the concept of resonance and solve coupled circuit problems
CO4: Carryout problems in DC and AC transients
CO5: Analyse and calculate three phase AC circuit parameters

TEXT BOOKS:

T1 William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, 2003.

T2 Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.

REFERENCE BOOKS:

R1 Paranjothi SR, "Electric Circuits Analysis", New Age International Ltd., New Delhi, 1996.

R2 Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series,Tata McGraw-Hill, NewDelhi, 2001.

R3 Chakrabati A, "Circuits Theory (Analysis and synthesis)", Dhanpath Rai & Sons, New Delhi, 1999.

R4 arles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	2	3									2	2	2
CO2	3	2	3									2	2	3
CO3	3	3	3		2		2					3	3	3
CO4	3	3	3				2					3	3	3
CO5	3	3	3		2		2					3	3	3
AVG	3	3	3		2		2					2.6	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
BE	22EE3203	Field Theory	3	0	0	3

Course Objectives

1. Understand the basic concepts in Electrostatics
2. To acquire a complete knowledge in Electrostatics.
3. Recognize the concepts in magneto statics
4. Understand the concepts of Electro Dynamic Fields
5. To know the properties and concepts of Electromagnetic waves

Unit	Description	Instructional Hours
I	**INTRODUCTION** Electrostatic fields – Vector Fields & Calculus - Various coordinate Systems(Cartesian Coordinate, Polar Coordinates) –Gradient, Divergence, Curl and Stokes – theorems and applications - Coulomb's Law – Gauss law and its Applications.	9
II	**STATIC ELECTRIC FIELD** Electric Potential - Potential due to point charge – Electric field and equipotential points, Uniform and Non-Uniform field– Electric field in free space, conductors, dielectrics - Dielectric polarization – Dielectric strength - Boundary conditions - Poisson's and Laplace's equations- Capacitance in different medium, coaxial cable and transmission line - Energy density - Applications.	9
III	**STATIC MAGENTIC FIELD** Lorentz force - Magnetic field intensity (H) - Magnetic flux density (B) – Biot–Savart's Law - Ampere's Circuit Law – point form of Ampere's Circuital Law– H & B due to straight conductors, Circular loop and Infinite sheet of current - Magnetic materials – Magnetization,– Boundary conditions - Scalar and Vector Magnetic Potential - Magnetic force, Torque – Inductance - Energy density Applications.	9
IV	**ELECTRODYNAMIC FIELDS** Magnetic Circuit - Faraday's law - Self Inductance and Mutual Inductance - Magnetic Circuits – Transformer(Static) and Motional(Dynamic) EMF – Current Densities (Displacement & Conduction) -Maxwell's equations (Differential and Integral form) Relation between field theory and circuit theory.	9
V	**ELECTROMAGNETIC WAVES** Electromagnetic waves propagation concepts – Plane Electromagnetic wave Equation – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy conductors and Dielectrics – Skin effect & skin depth – Plane wave reflection and refraction - Poynting Theorem- Standing wave ratio.	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Apply the Vector calculus application in Electromagnetics
- CO2 Analyse the concepts of Electrostatics
- CO3 Evaluate the concepts of Magnetostatics.
- CO4 Analyze the static and dynamic induced emf and determine the Maxwells equations.
- CO5 Analyse the propagation of plane Electromagnetic wave, Plane wave reflection and refraction.

TEXT BOOKS:

T1 K.A. Gangadhar, P.M. Ramanthan ' Electromagnetic Field Theory (including Antennaes and wave propagation', 16th Edition, Khanna Publications, 2007.

T2 Mathew N.O.Sadiku, 'Principles of Electromagnetics',4 th Edition ,Oxford University Press Inc.First India edition, 2009

REFERENCE BOOKS:

R1 Ashutosh Pramanik,"Electromagnetism – Theory and Applications", PHI Learning PVT LTD., 2nd Esition, 2009.

R2 Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Third Edition (Schaum's Outline Series), Tata McGraw Hill, 2010

R3 William H. Hayt and John A. Buck, 'Engineering Electromagnetics', Tata McGraw Hill 8th Revised edition, 2011.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3	3	2			1			1			2	2	3
CO2	3	3	1									1	2	3
CO3	3	3	2			2				1	1	1	3	3
CO4	3	2	1				1		1	2	1	3	3	2
CO5	3	2	2		2	1	1		1	1	1	3	3	3
AVG	3	2.6	1.6	1.8	2	1.333			1	1.333	1	2	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HICET * HINDUSTHAN COLLEGE OF ENGG & TECH
Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE	22EI3251	Digital Electronics	2	1	2	4

Common to EEE and EIE

Course Objectives

1. To understand different methods used for the simplification of Boolean functions
2. To study combinational circuits
3. To learn synchronous sequential circuits.
4. To infer the concepts of asynchronous sequential circuits and Programmable Logic Devices
5. To Interpret the fundamentals of HDL.

Unit	Description	Instructional Hours
I	**MINIMIZATION TECHINIQUES AND LOGIC GATES** Boolean algebra and laws – Demorgan's Theorem—Minimization of Boolean Expressions. Minterm - Maxterm- Sum of Product (SOP) – Product of Sum(POS) - Karnaugh map minimization - Don't care conditions. Simplification of Boolean expressions using logic gates : NAND and NOR - **Design of Boolean Functions using K-map.**	9+3
II	**COMBINATIONAL CIRCUITS** Analysis and design of combinational circuits- Adders, Subtractors, Multiplier, -Code converters – Magnitude comparator – Decoder and Encoder- Multiplexer and De-multiplexer – **Design of Adder and Subtractor circuits.**	9+3
III	**SYNCHRONOUS SEQUENTIAL CIRCUITS** Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering. Asynchronous and Synchronous type - counters –Modulo counters, Shift registers. Design of synchronous sequential circuits – Moore and Melay models- state diagram-state reduction- state assignment. **Design of Code converters: Excess-3 to BCD and vice-versa.**	9+3
IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES** Analysis of Asynchronous sequential logic circuits - Transition table, flow table - race conditions, hazards and errors in digital circuits. Introduction to Programmable Logic Devices: PROM – PLA –PAL - **Design of race conditions in digital circuits.**	9+3
V	**HDL** Introduction to Hardware Description Language. HDL for combinational circuits: Adders - Subtractors – Decoder and Encoder- Multiplexer and De-multiplexer. HDL for Sequential Circuits: flip-flops – counters- Registers - **Design of Multiplexer and De-multiplexer.**	9+3
	Total Instructional Hours	**60**

Course Outcomes

CO1: Apply the knowledge acquired about Boolean functions.
CO2: Summarize the concepts of combinational circuits.
CO3: Transform the acquired skill in designing the synchronous sequential circuits.
CO4: Ability to understand and analyze the asynchronous sequential circuits.
CO5: Outline the concepts of HDL.

TEXT BOOKS:

T1 - Raj Kamal, 'Digital systems-Principles and Design', Pearson Education 1st Edition, 2012.
T2 - M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.

REFERENCE BOOKS:

R1-Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
R2-Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
R3-Charles H.Roth, Jr,LizyLizy Kurian John, 'Digital System Design using VHDL, Cengage,2013.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2									2	2	2
CO2	2	2	2									2	2	3
CO3	2	3	2		2		2	2				3	3	3
CO4	3	3	3				2	2				3	3	3
CO5	3	3	3		2		2	2				3	3	3
AVG	2.4	2.6	2.4		2		2	2				2.6	2.6	2.8

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	P	T	C
B.E	22EE3001	Electric Circuit Laboratory Common to EEE and EIE	0	0	4	2

Course Objective

1. To provide practical experience on verification of kirchoff's voltage law, kirchoff's current law and network theorems.
2. To design series and parallel resonant circuit and to analyse the simulation results.
3. To compare the time constant values of RL,RC circuits by conducting suitable experiments
4. To measure three phase power using two wattmeter method
5. To provide knowledge on signal measurements using CRO and DSO

S.No	Description of the experiments	Total Practical Hours
1.	Experimental verification of Kirchhoff's voltage and current laws	
2.	Experimental verification of network theorems (Thevenin's and Superposition).	
3.	Experimental verification of network theorems (Reciprocity Theorem and Maximum power transfer Theorem).	
4.	Experimental determination of time constant of RL & RC electric circuits.	
5.	Experimental determination of frequency response of RLC circuits.	
6.	Design and Simulation of series resonance circuit.	
7.	Design and Simulation of parallel resonant circuits.	
8.	Simulation of three phases balanced and unbalanced star, delta networks circuits.	
9.	Experimental determination of power in three phase circuits by two-watt meter method.	
10.	Study of CRO, DSO and measurement of sinusoidal voltage, frequency and power factor	
	Total Instructional Hours	**45**

Course Outcome

CO1: Verify ohm's law and Kirchoff's law
CO2: Understand and verify theorems
CO3: Perform mesh and nodal analysis
CO4:Understand transient response of RL,RC circuits for DC input
CO5: Evaluate frequency response of series, parallel resonant circuits and tuned circuits

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	2	2	2		2			2	2	2		2	3	3
CO2	2	2	2		2	2		1	2	2		2	3	3
CO3	2	3	2		2	1	2	1	2	2		3	3	3
CO4	3	3	3		2	2	2	2	2	2		3	3	3
CO5	3	3	3		2	2	2	2	2	2		3	3	3
AVG	2.4	2.6	2.4		2	2	2	2	2	2		2.6	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E.	22EE3002	Electronic Devices and Circuits Laboratory	0	0	4	2

Course Objectives

1.Apply the knowledge gained in designing basic electronic circuits
2.Develop feedback amplifiers and oscillators
3. Construct and test the power supply circuits.

Expt. No.	Description of the Experiments
1.	Characteristics of a. Semi conductor diode b. Zener diode
2.	Characteristics of a NPN Transistor under a. Common Emitter Configuration b. Common Collector Configuration c. Common Base Configurations
3.	Characteristics of JFET & SCR
4.	Construct and testing of Single Phase half-wave rectifier
5.	Construct and testing Single Phase full wave rectifier
6.	Characteristics of UJT
7.	Implementation of Relaxation Oscillator
8.	Frequency response characteristics of a Common Emitter amplifier
9.	Construct and analyze the Current series Feedback Amplifier.
10.	Develop and testing of transistor RC phase shift oscillator
11.	Characteristics of photo diode and photo transistor

Total Practical Hours 45

Course Outcomes

CO1 Understand the characteristics of semiconductor devices
CO2 Develop various electronic circuit configurations.
CO3 Demonstrate the frequency response of amplifiers.
CO4 Examine the current series feedback amplifier and RC phase shift oscillator.
CO5 Construct and testing the of rectifier circuits.

REFERENCES:

R1. Poornachandra Rao S. and Sasikala B., —Handbook of experiments in Electronics and Communication Engineeringl, Vikas Publishing House Pvt. Ltd., New Delhi, 2007.
R2. Laboratory manual prepared by the Department of Electronics and Instrumentation Engineering, 2016.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO1	3.0	2.0	2.0	3.0		1.0						2.0	3.0	3.0
CO2	3.0	2.0	3.0	3.0		1.0						2.0	3.0	3.0
CO3	3.0	3.0	3.0	3.0	2.0	2.0	2.0					3.0	3.0	3.0
CO4	3.0	3.0	3.0	3.0			1.0	1.0				2.0	3.0	3.0
CO5	3.0	1.0	2.0	2.0	2.0	1.0	1.0	1.0		1.0	1.0	3.0	3.0	3.0
AVG	3.0	2.2	2.6	2.8	2.0	1.3	1.3	1.0	2.0	2.0	1.0	2.4	3.0	3.0

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22HE3071	Soft Skills and Aptitude - II	0	0	0	1

Course Objectives:

1. Solve Logical Reasoning questions of easy to intermediate level
2. Solve Quantitative Aptitude questions of easy to intermediate level
3. Solve Verbal Ability questions of easy to intermediate level
4. Display good writing skills while dealing with essays

Unit	Description	Instructional Hours
I	**Logical Reasoning** Clocks - Calendars - Direction Sense - Cubes - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	9
II	**Quantitative Aptitude** Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages - Time, Speed and Distance: Basics of time, speed and distance, Relative speed, Problems based on trains, Problems based on boats and streams, - Profit and loss, Basic terminologies in profit and loss - Averages - Weighted average	12
III	**Verbal Ability** Sentence Correction: Subject-Verb Agreement, Modifiers, Parallelism, Pronoun-Antecedent Agreement, Verb Time Sequences, Comparisons, Prepositions, Determiners - Sentence Completion and Para-jumbles: Pro-active thinking, Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues), Fixed jumbles, Anchored jumbles.	7
IV	**Writing skills for placements** Essay writing: Idea generation for topics, Best practices, Practice and feedback	2
	Total Instructional Hours	30

Course Outcome:

CO1: Students will avoid the various fallacies that can arise through the misuse of logic.

CO2: Students would opt for alternate methods to solve the problems rather than conventional methods.

CO3: Students will heighten their awareness of correct usage of English grammar in writing and speaking

CO4: Students will be concise and clear, using professional language for placements.

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE	22HE3072	Fundamentals of JAVA Programming	2	0	0	2

Course Objective

1. To understand Object Oriented programming concepts like Data Abstraction, Encapsulation
2. To analyze different types of constructor, Inheritance and polymorphism
3. To understand and apply package, Interface and Applet concepts
4. To understand and apply exception and i/o handling
5. To know the fundamental concepts of collection framework and multithreading in lving real world problems

Unit	Description	Instructional Hours
I	**Introduction to Object Oriented Programming** Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation	6
II	**Java Fundamentals** Introduction to java programming – Features of java-Classes and objects - Arrays -Methods-Constructor-Access Specifier - Nested Classes-Inner Classes -Command line arguments.	6
III	**Inheritance, packages and Interface:** Inheritance types -Method overriding - Abstract Classes- Packages-Interfaces	6
IV	**Exceptions and I/O handling:** Exception handling fundamentals-I/O basics – Reading console input – Writing console output-Files	6
V	**Applets, AWT and Event Handling:** Applet classes-AWT-event handling–multithreaded programming-Collection framework	6
	Total Instructional Hours	**30**

Course Outcome

- CO1: Identify and reproduce the features of Object Oriented programming paradigm.
- CO2: Interpret the fundamental concepts of collection framework algorithms and its uses
- CO3: Understand the basis of Package, multithreading, and interface concepts
- CO4: Use I/O functionality to code basic file operations and experiment with exceptions handling
- CO5: Apply the concepts of Applets, AWT and Event handling mechanism to solve a given problems.

TEXT BOOKS:

T1: Herbert Schildt, "Java : The Complete Reference", 9th edition, TMH, 2014.2017

T2: Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications,2014.

REFERENCE BOOKS:

R1: Daniel Liang ,"Introduction to Java Programming", 9th Edition , Prentice Hall Publications,2015

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

2022 Regulation – 2023 Batch III semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
NIL						

New Course Introduced (2022 Regulation) – 2023 Batch III semester

S.No	Regulation	Course Code with Name	Credits
NIL			

Chairman-BoS
Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

Dean Academics
Dean (Academics)
HiCET

Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A +' Grade)

Coimbatore-641032.

B.E ELECTRICAL AND ELCTRONICS ENGINEERING

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

CHOICE BASED CREDIT SYSTEM

Curriculum and Syllabus for the Batch 2022-26

Academic year 2024-2025 ODD

CURRICULUM
R2022

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E ELECTRICAL AND ELECTRONICS ENGINEERING (UG)

REGULATION-2022

SEMESTER I

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA1101	Matrices and Calculus (common to all branches)	BSC1	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2.	22HE1151	English for Engineers (Common to all branches)	HSC1	2	0	2	3	4	50	50	100
3.	22CY1151	Chemistry for Circuit Engineering	BSC2	2	0	2	3	4	50	50	100
4.	22ME1201	Engineering Drawing	ESC 1	1	0	4	3	5	50	50	100
5.	22CS1151	Problem Solving using C Programming	ESC2	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
6.	22HE1071	UHV (Common to all)	AEC	2	0	0	2	3	40	60	100
7.	22HE1072	Entrepreneurship & Innovation (Common to all)	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSE											
8.	22MC1091/ 22MC1092	தமிழரும் தொழில்நுட்பமும்/ Indian Constitution	MC	2	0	0	0	2	0	0	0
			TOTAL	15	1	10	19	27	380	320	700

SEMESTER II

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22MA2102	Differential Equations and Laplace Transforms	BSC3	3	1	0	4	4	40	60	100
2.	22CY2101	Environmental Studies (Common to all)	ESC3	2	0	0	2	3	40	60	100
3.	22PH2101	Basics of Material Science	BSC4	2	0	0	2	3	40	60	100
4.	22EE2201	Basics of Electrical and Communication Engineering	PCC	3	0	0	3	3	50	50	100
THEORY WITH LAB COMPONENT											

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

5.	22HE2151	Effective Technical Communication (Common to all)	HSC2	2	0	2	3	4	50	50	100
6.	22PH2151	Physics For Circuit Engineering	BSC5	2	0	2	3	4	50	50	100
		PRACTICAL									
7.	22ME2001	Engineering Practices(Common to all)	ESC	0	0	4	2	2	60	40	100
		EEC COURSES (SE/AE)									
8.	22HE2071	Design Thinking(Common to all)	AEC	2	0	0	2	2	100	0	100
9.	22HE2072	Soft Skills -1(Common to all)	AEC	1	0	0	1	1	100	0	100
		MANDATORY COURSE									
10.	22MC2091/ 22MC2092	தமிழர்மரபு/ Heritage of Tamil	MC	2	0	0	0	1	0	0	0
11.	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							-
			TOTAL	**19**	**1**	**8**	**22**	**27**	**520**	**380**	**900**

SEMESTER III

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
		THEORY									
1.	22MA3102	Complex Analysis and Transforms	BSC	3	1	0	4	4	40	60	100
2.	22EE3201	Electronic Devices and Circuits	PCC	3	0	0	3	3	40	60	100
3.	22EE3202	Electric Circuit Analysis	PCC	3	1	0	4	4	40	60	100
4.	22EE3203	Field Theory	PCC	3	0	0	3	4	40	60	100
		THEORY WITH LAB COMPONENT									
5.	22EI3251	Digital Electronics	ESC	2	1	2	4	4	50	50	100
		PRACTICAL									
6.	22EE3001	Electric Circuits Laboratory	ESC	0	0	4	2	4	60	40	100
7.	22EE3002	Electronic Devices and Circuits Laboratory	PCC	0	0	4	2	4	60	40	100
		EEC COURSES (SE/AE)									
8.	22HE3071	Soft Skills and Aptitude - II	SEC	1	0	0	1	1	100	0	100
9.	22HE3072	Fundamentals of JAVA Programming	AEC	2	0	0	2	2	40	60	100
		MANDATORY COURSE									
10	22MC3191	Essentials of Indian Traditional Knowledge	MC	2	0	0	0	2	0	0	0
			TOTAL	**17**	**3**	**10**	**25**	**30**	**470**	**430**	**900**

SEMESTER IV

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
		THEORY									
1.	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2.	22EE4201	Electrical Machines -I	PCC	3	0	0	3	3	40	60	100
3.	22EE4202	Integrated Circuits and Its Applications	PCC	3	1	0	4	4	40	60	100
4.	22EE4203	Transmission and Distribution	PCC	3	0	0	3	3	40	60	100
5.	22EE4204	Power Plant Engineering	PCC	3	0	0	3	3	40	60	100
		THEORY WITH LAB COMPONENT									
6.	22EI4251	Electrical and Electronic Measurements	PCC	2	0	2	3	4	50	50	100
		PRACTICAL									
7.	22EE4001	Electrical Machines- I Laboratory	PCC	0	0	4	2	4	60	40	100
8.	22EE4002	Integrated Circuits Laboratory	PCC	0	0	4	2	4	60	40	100
		EEC COURSES (SE/AE)									
9.	22HE4071	Soft Skills -III	SEC	1	0	0	1	1	100	0	100
10.	22EE4701	Internship - I*	SEC4	-	-	-	1		100	0	100
			TOTAL	**17**	**1**	**10**	**24**	**28**	**570**	**430**	**1000**

* Two weeks internship carries 1 credit and it will be done during Semester III summer vacation and same will be evaluated in Semester IV.
If students unable to undergo in semester III, then the Internship I offered in the semester IV can be clubbed with Internship II (Total: 4 weeks-2 credits)

SEMESTER V

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
		THEORY									
1.	22EE5201	Electrical Machines -II	PCC13	3	0	0	3	3	40	60	100
2.	22EE5202	Microprocessors and Microcontrollers	PCC14	3	0	0	3	3	40	60	100
3.	22EE53XX	Professional Elective-1	PEC1	3	0	0	3	3	40	60	100
4.	22EE53XX	Professional Elective-2	PEC2	3	0	0	3	3	40	60	100
5.	22EE53XX	Professional Elective-3	PEC3	3	0	0	3	3	40	60	100
		THEORY WITHLABCOMPONENT									
6.	22EI5251	Control Systems	PCC15	2	0	2	3	4	50	50	100
		PRACTICAL									
7.	22EE5001	Electrical Machines –II Laboratory	PCC16	0	0	4	1.5	3	60	40	100
8.	22EE5002	Microprocessors and Microcontrollers Laboratory	PCC16	0	0	4	1.5	3	60	40	100
		EEC COURSES (SE/AE)									
9.	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	10 0	0	100
			TOTAL	**18**	**0**	**10**	**22**	**26**	**470**	**430**	**900**

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH *
Chairman

SEMESTER VI

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE6201	Power Electronics	PCC17	3	0	0	3	3	40	60	100
2.	22EE6202	Power System Analysis	PCC18	3	0	0	3	3	40	60	100
3.	22HE6101	Professional Ethics	HSC6	3	0	0	3	3	40	60	100
4.	22EE63XX	Professional Elective-4	PEC4	3	0	0	3	3	40	60	100
5.	22EE63XX	Professional Elective-5	PEC5	3	0	0	3	3	40	60	100
6.	22XX64XX	Open Elective – 1*	OEC1	3	0	0	3	3	40	60	100
7.	22XX64XX	Open Elective – 2*	OEC1	3	0	0	3	3	40	60	100
PRACTICAL											
8.	22EE6001	Power Electronics Laboratory	PCC 19	0	0	3	1	3	60	40	100
EEC COURSES (SE/AE)											
9.	22HE6071	Soft Skills – 5	SEC	2	0	0	2	2	100	0	100
			TOTAL	**23**	**0**	**3**	**24**	**26**	**440**	**460**	**900**

SEMESTER VII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
THEORY											
1.	22EE7201	Protection and Switchgears	PCC20	3	0	0	3	3	40	60	100
2.	22EE73XX	Professional Elective-6	PEC6	3	0	0	3	3	40	60	100
3.	22XX7401	Open Elective – 3*	OEC3	3	0	0	3	3	40	60	100
4.	22LS74XX	Open Elective – 4*	OEC4	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
5.	22EE7201	Solid State Drives	PCC21	2	0	2	3	4	40	60	100
PRACTICAL											
6.	22EE7001	Power System Simulation Laboratory	PCC22	0	0	4	1.5	3	60	40	100
7.	22EE7002	Circuit Design Laboratory	PCC22	0	0	4	1.5	3	60	40	100
EEC COURSES (SE/AE)											
8.	22EE7701	Internship Training	SEC8	-	-	-	1	1	100	0	100
			TOTAL	**14**	**0**	**10**	**19**	**23**	**420**	**380**	**800**

* - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.

SEMESTER VIII

S. No	Course Code	Course Title	Category	L	T	P	C	TCP	CIA	ESE	Total
EEC COURSES (SE/AE)											
1.	22EE8901	Project Work/Granted Patent	SEC9	0	0	20	10	20	100	100	200
			TOTAL	0	0	20	10	20	100	100	200

Note:

* 1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.

2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.

3. The above-mentioned NCC Courses will be offered to the Students who are going to be admitted in the Academic Year 2021 – 22

OPEN ELECTIVE I AND II (EMERGINGTECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AI6401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6401	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6401	Cyber security	OEC	2	0	2	4	3
4	22EC6402	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6401	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6401	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACTPERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	**22EE6401**	Digital Marketing	OEC	3	0	0	3	3
13	**22EE6402**	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3

Note: Non Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22EE7401	Fundamentals of Solar Energy & its Applications	OEC	3	0	0	3	3
2	22EE7402	Electric Vehicles	OEC	3	0	0	3	3

OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Power Engineering	**Vertical II Machines and Converter Drives**	**Vertical III Embedded Systems**	**Vertical IV Electric Vehicle Technology**	**Vertical V Advanced Control**	**Vertical VI (Diversified Courses)**
22EE5301 Flexible AC Transmission Systems	22EE5304 Design of Electrical Machine	22EE5307 Embedded System	22EE5310 Electric Vehicle Architecture	22EE5313 Process Modeling and Simulation	22EE5316 Energy Storage Systems
22EE5302 High Voltage Engineering	22EE5305 Special Electrical Machines	22EE5308 Microcontroller Based System Design	22EE5311 Automotive Electronics	22EE5314 Computer Control of Processes	22EE5317 Hybrid Energy Technology
22EE5303 Smart Grid	22EE5306 Power Semiconductor Devices	22EE5309 Software for Embedded Systems	22EE5312 Design of Motor and Power Converters for Electric Vehicles	22EE5315 Model Based Control	22EE5318 Design and Modelling of Renewable Energy Systems
22EE6301 Power System Operation and Control	22EE6303 Utilization and Conservation of Electrical Energy	22EE6305 Internet of Things	22EE6307 Design of Electric Vehicle Charging System	22EE6309 Non Linear Control	22EE6311 Sustainable and Environmental Friendly HV Insulation System
22EE6302 High Voltage Direct Current Transmission	22EE6304 SMPS and UPS	22EE6306 Embedded Controlfor Electric Drives	22EE6308 Electric Vehicle Design, Mechanics and Control	22EE6310 Optimal Control	22EE6312 Power System Transients
22EE7301 Power Quality	22EE7302 Power Electronics for Renewable Energy Systems	22EE7303 Embedded System for Automotive Applications	22EE7304 Testing of Electric Vehicles	22EE7305 Adaptive Control	22EE7306 PLC Programming

Note: Students are permitted to choose all professional electives from any of the verticals.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

DETAILS OF VERTICAL I: Power Engineering

SL. NO.	COURSE C ODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5301	High Voltage Direct Current Transmission	PEC	3	0	0	3	3
2.	22EE5302	High Voltage Engineering	PEC	3	0	0	3	3
3.	22EE5303	Power Quality	PEC	3	0	0	3	3
4.	22EE6301	Power System Operation and Control	PEC	3	0	0	3	3
5.	22EE6302	Flexible AC Transmission Systems	PEC	3	0	0	3	3
6.	22EE7301	Energy Management and Auditing	PEC	3	0	0	3	3

DETAILS OF VERTICAL II: Machines and Converter Drives

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5304	Design of Electrical Machines	PEC	3	0	0	3	3
2.	22EE5305	Special Electrical Machines	PEC	3	0	0	3	3
3.	22EE5306	Power Semiconductor Devices	PEC	3	0	0	3	3
4.	22EE6303	Power Electronics for Renewable Energy Systems	PEC	3	0	0	3	3
5.	22EE6304	SMPS and UPS	PEC	3	0	0	3	3
6.	22EE7302	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3

DETAILS OF VERTICAL III: Embedded Systems

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5307	Embedded System	PEC	3	0	0	3	3
2.	22EE5308	Microcontroller Based System Design	PEC	3	0	0	3	3
3.	22EE5309	Software for Embedded Systems	PEC	3	0	0	3	3
4.	22EE6305	Internet of Things	PEC	3	0	0	3	3
5.	22EE6306	Embedded Control for Electric Drives	PEC	3	0	0	3	3
6.	22EE7303	Embedded System for Automotive Applications	PEC	3	0	0	3	3

DETAILS OF VERTICAL IV: Electric Vehicle Technology

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5310	Electric Vehicle Architecture	PEC	3	0	0	3	3
2.	22EE5311	Automotive Electronics	PEC	3	0	0	3	3
3.	22EE5312	Design of Motor and Power Converters for Electric Vehicles	PEC	3	0	0	3	3
4.	22EE6307	Design of Electric Vehicle Charging System	PEC	3	0	0	3	3
5.	22EE6308	Electric Vehicle Design, Mechanics and Control	PEC	3	0	0	3	3
6.	22EE7304	Testing of Electric Vehicles	PEC	3	0	0	3	3

DETAILS OF VERTICAL V: Advanced Control

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5313	Process Modeling and Simulation	PEC	3	0	0	3	3
2.	22EE5314	Computer Control of Processes	PEC	3	0	0	3	3
3.	22EE5315	Model Based Control	PEC	3	0	0	3	3
4.	22EE6309	Non Linear Control	PEC	3	0	0	3	3
5.	22EE6310	Optimal Control	PEC	3	0	0	3	3
6.	22EE7305	Adaptive Control	PEC	3	0	0	3	3

DETAILS OF VERTICAL VI: (Diversified Courses)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	22EE5316	Energy Storage Systems	PEC	3	0	0	3	3
2.	22EE5317	Hybrid Energy Technology	PEC	3	0	0	3	3
3.	22EE5318	Design and Modelling of Renewable Energy Systems	PEC	3	0	0	3	3
4.	22EE6311	Sustainable and Environmental Friendly HV Insulation System	PEC	3	0	0	3	3
5.	22EE6312	Power System Transients	PEC	3	0	0	3	3
6.	22EE7306	PLC Programming	PEC	3	0	0	3	3

Enrolment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree(Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree –

ELECTRICAL AND ELECTRONICS ENGINEERING OFFERING

MINOR DEGREE: RENEWABLE ENERGY ENGINEERING

S No	Course Code	Course Title	Category	Periods Per week			Total Contac Periods	Credits
				L	T	P		
1	22EE5601	Sem 5:Introduction to Energy Studies	MDC	3	0	0	3	3
2.	22EE6601	Sem 6:Power plant Engineering	MDC	3	0	0	3	3
3.	22EE6602	Sem 6:Solar photovoltaic Fundamentals and Its Applications	MDC	3	0	0	3	3
4.	22EE7601	Sem 7:Wind Energy Conversion System	MDC	3	0	0	3	3
5.	22EE7602	Sem 7:Energy Storage Systems	MDC	3	0	0	3	3
6.	22EE8601	Sem 8: Power plant Instrumentation	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CS5602	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III

Environment and Sustainability

SNo	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B.E (Hons) Electrical and Electronics Engineering with Specialization in Energy engineering

S.no.	Course code	Course title	Category	Periods per week				TCP	CIA	ESE	Total
				L	T	P	C				
1.	22EE5206	Sem 5:Energy Management & Auditing	PC	2	0	2	3	4	40	60	100
2.	22EE6205	Sem 6: Advanced Power Plant Engineering	PC	2	0	2	3	4	40	60	100
3.	22EE6206	Sem 6: Instrumentation for Energy Systems	PC	3	0	0	3	3	40	60	100
4.	22EE7205	Sem 7:Energy Conversion Techniques	PC	2	0	2	3	4	40	60	100
5.	22EE7206	Sem 7:Electric vehicle Machines and Drives	PC	2	0	2	3	4	40	60	100
6.	22EE8202	Sem 8:Wind Energy Conversion System	PC	2	0	2	3	4	40	60	100

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	11
2	BSC	7	9	4	-	-	-	-	-	20
3	ESC	6	4	5	-	-	-	-	-	15
4	PCC	-	3	13	20	12	7	9	-	64
5	PEC	-	-	-	-	9	9	-	-	18
6	OEC	-	-	-	-	-	3	9	-	12
7	EEC	3	3	3	1	1	2	2	10	25
8	MCC		↓	↓	↓					
	Total	19	22	25	23	22	24	20	10	165

Credit Distribution R2022

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19	22	25	23	22	24	20	10	165

Chairman-BoS

Chairman - BoS
EEE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5201	Electrical Machines II	3	0	0	3

Course Objective

The student should be able to

1. Obtain the performance of three phase induction motor and draw its characteristics.
2. Understand the working of Starters and speed control techniques of three-phase induction motors
3. Discuss the basic principles and determine the performance of single phase induction motor
4. Obtain the performance of three phase synchronous generator
5. Estimate the excitation in synchronous motor at various load conditions.

Unit	Description	Instructional Hours
I	**THREE PHASE INDUCTION MOTORS** Construction - Principle of operation - slip and Frequency of rotor currents - Equivalent circuit - Power across air-gap, Torque & Power output - Torque-slip characteristics - No load and Blocked rotor tests - Circle diagram (approximate) - Cogging and Crawling - Induction generator - Applications	9
II	**STARTING, BRAKING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS** Need for starters - Types of Starters: DOL, Rotor resistance, Autotransformer and Star-Delta starters - Braking: Plugging, Dynamic braking and Regenerative braking - Speed control techniques: V/F Control - Voltage control - Pole changing – Rotor resistance control – Slip power recovery schemes	9
III	**SINGLE PHASE INDUCTION MOTORS** Single phase induction motors - Double revolving field theory - Split phase motor - Capacitor start motor - Capacitor start and run motor - Shaded pole motor. No load and Blocked rotor test - Equivalent circuit – Stepper motor Applications.	9
IV	**SYNCHRONOUS GENERATORS** Construction - Working Principle - e.m.f equation - armature reaction - Synchronous reactance - Voltage regulation – Synchronous Impedance and Ampere-turns Methods – Blondel's theory of Salient pole machine – Determination of Xd and Xq using slip test.	9
V	**SYNCHRONOUS MOTOR** Principle of operation – Methods of Starting Synchronous motors – Operation of synchronous motor at constant load variable excitation - V curves and inverted V curves - Hunting and suppression methods: Damper windings - Synchronous condenser-Concepts of PMSM.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Analyze and draw the performance characteristics of the three phase induction motor.
CO2: Demonstrate the starters for starting and control the speed of three phase induction motors
CO3: State the fundamentals and evaluate the performance of single phase induction motors
CO4: Apply different methods to obtain the regulation of synchronous generator under various load condition
CO5: Draw the performance characteristics of synchronous motor under different excitation conditions

TEXT BOOKS:

T1 - D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2006
T2 - .Gnanavadivel, Dr.C.Senthil Kumar, Dr.P.Maruthapandi, "Electrical Machines II" Anuradha Publications, 2017

REFERENCE BOOKS:

R1 - .P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
R2 - K. Murugesh Kumar, 'Induction and Synchronous Machines', Vikas Publishing House Pvt. Ltd, 2009.
R3 - Fitzgerald Kingsley and Umans, "Electric Machinery" 6th Edition, McGraw Hill Books co., New Delhi, 2002.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3			1	2	2				2	2	3
CO2	2	2	3			1	2	2				2	3	3
CO3	3	3	3		1	1	1	2				2	2	3
CO4	3	3	3			1	1	2			1	2	3	3
CO5	3	3	3		1	2	1	2	1		1	2	2	3
Avg	2.8	2.8	3		1	1.2	1.4	2.0	1		1	2	2.4	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5202	Microprocessors and Microcontrollers	3	0	0	3

The student should be able to

Course Objective

1. Understand the fundamental components of 8085 architecture.
2. Understand the concept of peripheral's interfacing with assembly language programming
3. Study the fundamental architecture of 8051 microcontroller and its programming concepts.
4. Understand the fundamental and programming concepts of arduino uno controller
5. Learn the architecture study of advance microprocessors and microcontrollers

Unit	Description	Instructional Hours
I	**Intel 8085 PROCESSOR** 8085 architecture– Pin diagram -Interrupts - Addressing Modes - Instruction set - Stack and Subroutine Instructions - Simple Assembly Language Programming	9
II	**8085 INTERFACING** Architecture and Programming of Peripheral IC's:8255 PPI, 8259 PIC, 8251 USART,8279 Keyboard Display Controller and 8253 Timer/ Counter.	9
III	**8051 MICROCONTROLLER** Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports –Interfacing: LED – 7 segment display – Keypad - Simple programming	9
IV	**ARDUINO UNO CONTROLLER** AVR Architecture – pin diagram – Concept of digital and analog ports - Programming concepts IDE: Arduino data types – Variables and constants – Arrays and strings- Functions –Simple programming examples	9
V	**MICROCONTROLLER APPLICATIONS** Closed Loop Control of Servo Motor, Stepper Motor and Washing Machine Control - Arduino based Control of Traffic Lights, Home Automation System -Introduction to Raspberry pi.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Study the architecture of 8085 microprocessor and programming concept involved in 8085.
CO2: Understand the commonly used peripheral/ interfacing IC's with its programming.
CO3: Understand the architecture and programming concepts of 8051 microcontroller.
CO4: Learn the advanced controller fundamentals and programming
CO5: Understand the applications and role of advanced microcontrollers

TEXT BOOKS:

T1 - R. S. Gaonkar, "Microprocessor Architecture Programming and Application", Penram International Publishing Private limited, 6th edition, Oct 2013.

T2 - . Jeremy Blum, "Exploring Arduino: Tools and Techniques for Engineering Wizardry", John Wiley & Sons, Inc.2nd Edition, Oct 2021

REFERENCE BOOKS:

R1 - . Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.Mckinlay, "The 8051 microcontroller and embedded systems using assembly and C", 2nd Edition, Pearson Education, 2011

R2- Krishna Kant, "Microprocessors and Microcontrollers", Prentice –Hall of India, New Delhi, 2017

R3 - J. M. Hughes, "Arduino: A Technical Reference", 1st Edition, O'Reilly Media, Inc, USA, 2016

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			1						3	3	3
CO2	3	2	2			1	2			3		3	3	3
CO3	3	2	2			2	2	1	1	2		3	3	3
CO4	3	2	2		1	1	2	1		2		3	3	3
CO5	3	2	2		1	3	2	1	2	2		3	3	3
Avg	3	2	2		1	1.6	2	1	1.5	2.25		3	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EI5251	Control System Common to EEE &EIE	2	0	2	3

The student should be able to

Course Objective

1. Understand the basics of control system and its modeling.
2. Impart knowledge about time domain systems.
3. Facilitate on frequency domain analysis methods.
4. Establish methods of stability analysis and controller compensators.
5. Outline on state space and sampled data control systems

Unit	Description	Instructional Hours
I	**CONTROL SYSTEM MODELLING** Control System: Terminology and Basic Structure - Open and closed loop systems – Transfer Function models – Mechanical and Electrical systems – Analogies: Force – voltage, Force - current & Torque – voltage, Torque - current – Synchros – AC and DC servomotors - ***Simulation of basic blocks of control system using MATLAB***	6+3
II	**TIME RESPONSE ANALYSIS** Block diagram reduction techniques – Signal flow graphs – Standard test signals – Order of a system –step, impulse response of first order systems – second order system – Time domain specifications – Effect on an additional zero and an additional pole - Static Error constants – Steady state error. ***Simulation of time response of First and Second order system using MATLAB***	6+3
III	**FREQUENCY RESPONSE ANALYSIS** Frequency response – Frequency domain specifications – Bode plot – Polar plot – M and N Circles - Phase margin and gain margin - Correlation between frequency and time domain specifications. ***Simulation of Bode plot using MATLAB, Simulation of Polar plot using MATLAB***	6+3
IV	**STABILITY ANALYSIS AND COMPENSATOR DESIGN** Characteristics equation – Routh Hurwitz criterion – Relative and conditional stability, Root locus, construction, stability criterion - Effects of P,PI,PID controllers - Compensator – Types – Lag, lead and lag-lead networks – Lag-Lead compensator design using Bode plot. ***Simulation of Root Locus using MATLAB***	6+3
V	**STATE MODELS AND SAMPLED DATA SYSTEMS** Concept of state and state models – State models for linear and time invariant Systems – State model of Armature and Field control system – Solution of state and output equation - Concept of Controllability and Observability. Introduction to digital control system, Introduction of Digital Controllers (Qualitative Treatment only). ***Problem simulation in MATLAB using state model***	6+3
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply the gained knowledge for modeling of mechanical, electrical control systems.
CO2: Analyze the different order systems with various inputs and their response.
CO3: Estimate the various frequency domain specifications by phase analysis.
CO4: Realize the various stability criterion techniques and compensators.
CO5: Develop a state model of various systems and analyze their stability.

TEXT BOOKS:

T1 - M. Gopal, 'Control Systems, Principles and Design', 4th Edition, Tafa McGraw Hill, New Delhi, 2012.
T2 - S.K.Bhattacharya, Control System Engineering, 3rd Edition, Pearson, 2013

REFERENCE BOOKS:

R1 - . Dhanesh. N. Manik, Control System, Cengage Learning, 2012.
R2- Benjamin C. Kuo, Automatic Control systems, 7th Edition, PHI, 2010
R3 - S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	3	3	1	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3
Avg	3	3	2.6	2.6	1	-	-	-	-	-	-	2	2.6	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5001	Electrical Machines Laboratory II	0	0	3	1.5

Course Objectives

1 Determine the losses and performance characteristics of single phase and three phase Induction Motor using appropriate tests.
2 Study the operation and speed control of AC Machines and Starters.
3 Determine the regulation of synchronous machines using various methods.

EXPT.NO	Description of the Experiments
1.	Load test on three-phase Squirrel cage induction motor or Slip ring induction motor.
2.	Determination of equivalent circuit parameters on three-phase induction motor.
3.	Speed control of three phase induction motor
4.	Load test on single-phase induction motor.
5.	No load and blocked rotor test on single-phase induction motor.
6.	Regulation of three phase alternator by EMF Method
7.	Regulation of three phase alternator by MMF Method.
8.	Determination of X_d an X_q for three phase salient pole alternator by slip test
9.	V and Inverted V curves of Three Phase Synchronous Motor
10.	Study of Induction motor starters (DOL, Automatic Star/Delta & 3 Phase Autotransformer)

Total Practical Hours 45 Hours

Course Outcomes	CO1	Perform load test on Induction motors and comment their performance characteristics.
	CO2	Determine the internal parameters of three phase induction motor through an equivalent circuit
	CO3	Analyze the methods of speed control in three phase induction motor
	CO4	Predetermine the regulation of three phase alternator by EMF, MMF Methods
	CO5	Draw the performance characteristics of three phase synchronous motor.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1		1		1				2	3	3
CO2	3	3	2	1		1				2		2	3	3
CO3	3	3	2	1	1	1		1		2		2	3	3
CO4	3	3	2	1		1		1		2	1	2	3	3
CO5	3	3	2	1	1	2		1	1		1	2	3	3
Avg	3	3	2	1	1	1.2		1	1	2	1	2	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

Programme/Sem	Course Code	Name of the course	L	T	P	C
BE/V	22EE5002	Microprocessors and Microcontrollers Laboratory (Common To EEE And EIE)	0	0	3	1.5

Course Objective

1. Understand the assembly language programming with simple examples using 8085.
2. Study the concept of peripheral's interfacing with assembly language programming using 8085.
3. Learn the assembly language programming with simple examples using 8051.
4. Practice the basic programming concept and interfacing sensor of Arduino.
5. Propose the concepts of Industrial drive interfacing concepts with programming.

Expt. No. **Description of the Experiments**

1. Arithmetic operations using 8085 microprocessor: 8-bit Basic Arithmetic operations.
2. 8085 Programming: Sorting Operations & Max / Min of numbers.
3. A/D interfacing and D/A interfacing with microprocessor.
4. Keyboard and 7-segment display interface with 8279 Interfacing.
5. Programming demonstration of basic function with 8051 microcontroller execution.
6. Simple basic programming of Arduino microcontroller.
7. Digital and Analog interfacing using Arduino microcontroller.
8. Interface the stepper motor to perform clockwise and anti-clock wise rotation.
9. Traffic light control interfacing with 8051.
10. Mini Project /Small Project Application.

Total Practical Hours 45

Course Outcome

CO1: Understand the 8085architecture and its programming execution.
CO2: Learn interfacing knowledge with different applications.
CO3: Study the simple and interfacing programming concepts of 8051.
CO4: Understand the Interfacing and basic programming concept of Arduino.
CO5: Understand the industrial application of microcontroller by various programming concepts.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2					1	3	3	2
CO2	3	2	2			2	2			3	2	3	3	2
CO3	3	2	2			1	2	1	1	2	2	3	3	2
CO4	3	2	3		1	1	2	1		2	2	3	3	2
CO5	2	2	2		1	1	2	1	2	2	2	3	3	2
Avg	2.8	2.2	2.4		1	1.4	2	1	1.5	2.25	1.8	3	3	2

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5301	Flexible AC Transmission Systems	3	0	0	3

The student should be able to

Course Objective

1. Study and understand the concepts of reactive power and its control.
2. Gain knowledge on various control techniques of static VAR compensator and its applications.
3. Learn the control techniques of TCSC and its applications.
4. Understand the concepts of various emerging FACTS controllers.
5. Understand the various combined compensators and FACTS controllers coordination and interaction

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FACTS** Review of basics of power transmission networks - Concepts of Reactive power and its control in transmission lines - Uncompensated AC Transmission line - Passive compensation (series and shunt compensation) – Need for FACTS controllers- Types and generation of FACTS controllers – Basic concepts of FACTS devices and its functions.).	9
II	**STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS** Basics concept and working of SVC - Voltage control by SVC – Advantages of slope in dynamic Characteristics – Influence of SVC on system voltage –SVC voltage regulator (Block diagram approach) – Applications: Enhancement of transient stability–Enhancement of power system damping	9
III	**THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS** Block diagram and Operation of the TCSC – Different modes of operation –Bypassed Thyristor Mode, Blocked Thyristor Modes and Vernier Mode – Applications: Improvement of the system stability limit – Enhancement of system damping.	9
IV	**EMERGING FACTS CONTROLLERS** Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics - Applications: Steady state power transfer - Prevention of voltage instability - SSSC - Operation of SSSC and the control of power flow.	9
V	**COMBINED COMPENSATORS & CO-ORDINATION OF FACTS CONTROLLERS** UPFC & IPFC - Operating principle (Block diagram approach) & applications - FACTS Controller interactions - Co-ordination of multiple controllers using Linear Control Techniques - Control coordination using Genetic algorithms flowchart representation.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Describe the reactive power control techniques.
CO2: Explain various control techniques of SVC compensator..
CO3: Acquire knowledge on the control techniques of TCSC and its applications.
CO4: Explain the function of various emerging FACTS controllers
CO5: Illustrate combined compensators and coordination of FACTS controllers

TEXT BOOKS:

T1 - R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002.

T2 - Narain G. Hingorani, "Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi- 110 006, 2011.

REFERENCE BOOKS:

R1 - A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical Engineers, UK, 2219

R2- V.K.Sood, "HVDC and FACTS controllers – Applications of Static Converters in Power System", Kluwer Academic Publishers, 2004

R3 - K.R.Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International, 2007

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3				1	1				2	3	3
CO2	3	3	3	1			2	1				3	3	3
CO3	3	3	3				1	2		1		3	3	3
CO4	3	3	3	1		2	1	2	1			3	3	3
CO5	3	3	3	1		2	1	2	1			3	3	3
Avg	3	3	3	1		2	1.2	1.6	1	1		2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5304	Design of Electrical Machines	3	0	0	3

The student should be able to

Course Objective

1. Interpret the fundamentals of specific loading and ratings of electrical machines
2. Design armature and field systems of D.C. machines
3. Analyze and design core, yoke, windings and cooling systems of transformers
4. Design stator and rotor of induction machines
5. Outline the behavior of synchronous machines and design stator and rotor.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Major considerations in Electrical Machine Design – Electrical Engineering Materials – Choice of Specific Electrical and Magnetic loadings – Thermal considerations, Rating of machines – Different types of cooling methods.	9
	DC MACHINES	
II	Output Equations – Main Dimensions – Choice of Specific Electric and Magnetic Loading – Magnetic Circuits Calculations – Carter's Coefficient – Net length of Iron –Real & Apparent flux densities –Selection of number of poles – Design of Armature	9
	TRANSFORMERS	
III	Output Equations – Main Dimensions – kVA output for single and three phase transformers – Window space factor — Overall dimensions – No load current – Temperature rise in Transformers – Design of Tank – Methods of cooling of Transformers	9
	INDUCTION MOTORS	
IV	Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Magnetizing current – Short circuit current.	9
	SYNCHRONOUS MACHINES	
V	Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Design of field winding	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Apply the knowledge acquired from Specific loading and rating of electrical machines.
CO2: Understand the design concepts and apply to design the Main dimensions of DC Machine
CO3: Provide the solutions for Transformer cooling
CO4: Understand the design concepts and apply to design the Main dimensions of Induction Machine
CO5: Analyze and design the Main dimensions of Synchronous machines.

TEXT BOOKS:

T1 - Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 2014
T2 - . .V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010

REFERENCE BOOKS:

R1 - .A.ShanmugaSundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
R2 - R.K.Agarwal" Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
R3 - Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2017

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2						3	3	3
CO2	3	3	2			2	2					3	3	3
CO3	3	3	2			3	2	1				3	3	3
CO4	3	3	2		2	3	2	1				3	3	3
CO5	3	3	2		2	3	2	1				3	3	3
Avg	3	3	2		2	2.6	2	1				3	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5307	Embedded Systems	3	0	0	3

The student should be able to

Course Objective

1. Understand the general purpose system and embedded system
2. Describe the components and compilation techniques in an embedded system
3. Impart Knowledge in Various processor scheduling algorithms
4. Differentiate the RTOS concepts to design and develop real time projects
5. Develop Process flow to design and implement an embedded system using case studies.

Unit	Description	Instructional Hours
	INTRODUCTION TO EMBEDDED SYSTEM	
I	Basics of Developing and Functional building block of embedded system - Characteristics of embedded system applications - Structural units in Embedded processor -Challenges in embedded system design -	9
	ARCHITECTURE OF EMBEDDED SYSTEM	
II	PIC Microcontroller – Architecture of PIC 16F8xx -Supervisor mode, Exceptions & Traps, Co-processors, - CPU bus - Memory devices - I/O devices -Assembly and linking.	9
	OS FOR EMBEDDED SYSTEMS	
III	Introduction to RTOS. Task. process & threads. interrupt routines in RTOS. Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling – Semaphores- Types of operating systems -Introduction to µC/ OS II .	9
	DEVELOPMENT ENVIRONMENT AND PERFORMANCE ISSUSES	
IV	Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modeling of EDLC; issues in Hardware-software Co-design..	9
	REAL TIME APPLICATIONS	
V	Design examples: ACVM, Washing Machines, Cell phones, Digital Still Cameras, Smart card applications.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand The Basic Structure of Embedded Processors.
CO2: Acquire the knowledge in the architecture of Embedded System
CO3: Articulate the knowledge in operating systems for embedded process
CO4: Outline RTOS concepts and issues in embedded system design process.
CO5: Demonstrate the design and implementation process of real time products.

TEXT BOOKS:

T1 - Rajkamal, "Embedded Systems – Architecture, Programming and Design", Tata McGraw-Hill, New Delhi, 2017.
T2 - Sangiovanni-Vincentelli,"Embedded Systems Development From Functional Models To Implementations",springer 2021

REFERENCE BOOKS:

R1 - Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2016.
R2 - Wayne Wolf, "Computers as Components: Principles of Embedded Computer Systems Design", Reed Elsevier Publications, Gurgaon, Haryana, 2013
R3 - Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2013

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	2					1				2	3	3
CO2	2	2	3					1				3	3	3
CO3	3	3	2			2		2				3	3	3
CO4	3	2	3			2		2				3	3	3
CO5	2	2	3			2		2				3	3	3
Avg	2.4	2.2	2.6			2		1.6				2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5310	Electric Vehicle Architecture	3	0	0	3

Course Objective

The student should be able to

1. Understand the fundamental principles of electric vehicle architecture
2. Analyze different types of electric vehicle architectures and their advantages/disadvantages.
3. Evaluate the integration of key components such as electric motors, power electronics, and batteries
4. Explore advanced topics such as regenerative braking, thermal management, and vehicle-to-grid (V2G) integration
5. Apply knowledge through hands-on projects and case studies to design and optimize electric vehicle architectures.

Unit	Description	Instructional Hours
I	**Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train** Hybrid Electric Vehicles (HEV): The gasoline ICE and battery, Diesel ICE and battery, Battery and FC, Battery and capacitor, Battery and flywheel, Battery and battery hybrids. Energy use in conventional vehicles, Energy saving potential of hybrid drive trains: Regenerative braking, More efficient operation of the ICE, including reduction of idle, Smaller ICE, Potential for higher weight, Electrical losses.	9
II	**Power Flow in HEVs –I** Power Flow Control: Optimal ICE operating point, Optimal ICE operating line, Safe battery voltage. Power Flow Control in Series Hybrid: Mode 1, normal driving or acceleration, Mode 2, light load, Mode 3, braking or deceleration, Mode 4, vehicle at stop. Power Flow Control in Parallel Hybrid: Mode 1, start up, Mode 2, normal driving, Mode 3, braking or deceleration, Mode 4, light load	9
III	**Power Flow in HEVs -II** Power Flow Control in Series-Parallel Hybrid: Mode 1: At startup, Mode 2: During full throttle acceleration, Mode 3: During normal driving, Mode 4: During normal braking or deceleration, Mode 5: To charge the battery during driving, Mode 6: When the vehicle is at standstill, The operating modes of EM dominated system, Power Flow Control Complex Hybrid Control	9
IV	**Torque Coupling and Analysis of Parallel Drive Train** Introduction to Parallel Hybrid Electric Drive Train, Torque Coupling, Speed Coupling, Post-Transmission Parallel Hybrid Drive Train with Torque Coupling, Pre-Transmission Parallel Hybrid Drive Train with Torque Coupling, Parallel Hybrid Drive Train with Speed Coupling: Hybrid traction, Engine alone traction, Motor alone traction, Regenerative braking, Battery charging from the ICE. Complex Hybrid Drivetrain.	9
V	**Basic Architecture of Electric Drive Trains-I** Electric Vehicle (EV) Configuration: Electric propulsion-The electronic controller, Power converter, Electric Motor (EM), Mechanical transmission, Driving wheels. Energy source-The energy source (battery, fuel cell, ultra-capacitor), Energy management unit, Energy refueling unit. Auxiliary system-Power steering unit, Temperature control unit, Auxiliary power supply	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the Architecture of HEV.
CO2: Analyse the power flow in series and parallel HEV
CO3: Analysis of Parallel Drive Train and Torque Coupling
CO4: Understand the concept of Basic Architecture of Electric Drive Trains.
CO5: Understand the concept of EV configuration.

TEXT BOOKS:

T1 - . M. Ehsani,:Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press,2005
T2 - K.T.Chau, Zheng Wang, Chaos in Electrical Drive Systems: Analysis, Control & Applications, 1st Edition, John Wiley and Sons, 2011

REFERENCE BOOKS:

R1 - L. Guzzella and A. Sciarretta: Vehicle Propulsion Systems: Introduction to Modeling and Optimization, Springer, 2007, fifth edition.
R2 - Springer Books, Electrical Vehicle Integration into Modern Power Networks
R3 - John Lowry, John Wiley and Sons, Electrical Vehicle Technology Explained-James Larminie, 1st Edition, 2003

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	2					1				2	3	3
CO2	2	2	3					1				3	3	3
CO3	3	3	2			2		2				3	3	3
CO4	3	2	3			2		2				3	3	3
CO5	2	2	3			2		2				3	3	3
Avg	2.4	2.2	2.6			2		1.6				2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5313	Process Modeling and Simulation	3	0	0	3

Course Objective

The student should be able to

1. Recognize the significance of mathematical models in representing and studying industrial processes.
2. Familiarize students with the various forms and structures of mathematical models
3. Develop skills in formulating and simulating mathematical models for diverse industrial processes
4. Apply relevant mathematical tools and techniques in the process of developing mathematical models
5. Analyze and interpret the graphical representations and behavior of the developed mathematical models..

Unit	Description	Instructional Hours
I	**BASIC PRINCIPLES OF MODELLING** Introduction to mathematical modelling - Advantages and limitations of models and applications of process models of stand-alone unit operations and unit processes - Classification of models - Linear vs Nonlinear - Lumped parameter vs Distributed parameter - Static vs Dynamic - Continuous vs Discrete - Numerical Methods - Iterative convergence methods - Numerical integration of ODE - IVP and ODEBVP	9
II	**MODELLING OF DISTRIBUTED PROCESSES** Steady state models giving rise to differential algebraic equation (DAE) systems – Rate based Approaches for staged processes - Modeling of differential contactors – distributed parameter models of packed beds - Packed bed reactors - Modeling of reactive separation processes - Review of solution strategies for Differential Algebraic Equations (DAEs) – Partial Differential Equations (PDEs) and available numerical software libraries.	9
III	**PROCESS MODELLING** Concept of degree of freedom analysis - System and its subsystem - System interaction – Degree of free domin a system e.g. Heat exchanger, Equilibrium still, Reversal of information flow, Design variable selection algorithm, Information flow through subsystems - Structural effects of design variable selection – Persistent Recycle.	9
IV	**MODELLING Of INDUSTRIAL PROCESSES** Simple examples of process models - Models giving rise to nonlinear algebraic equation (NAE) systems - steady state models of flash vessels - Equilibrium staged processes distillation columns - Absorbers, Strippers, CSTR, heat exchangers, etc. - Review of solution procedures and available numerical software libraries.	9
V	**SIMULATION OF MATHEMATICAL MODELLING** Simulation and their approaches, Modular, Sequential, Simultaneous and Equation solving approach - Simulation softwares and their applications - Review of solution techniques and available numerical software libraries - Case Studies.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Acquire a comprehensive understanding of various methodologies for constructing models that represent industrial processes.

CO2: Develop proficiency in formulating mathematical models by applying appropriate mathematical concepts and techniques.

CO3: Gain the ability to implement and simulate mathematical models using relevant software tools and programming languages.

CO4: Cultivate skills in analyzing and drawing well-founded conclusions from the developed mathematical models.

CO5: Interpret and translate the results obtained from mathematical models into meaningful insights and solutions for the original real-world problem or industrial process under consideration.

TEXT BOOKS:

T1 - Denn M. M.,"Process Modeling", Longman, 1986, 1st Edition

T2 - Aris R.,"Mathematical Modeling, A Chemical Engineering Perspective (Process System Engineering)", Academic Press, 1999, Volume 1

REFERENCE BOOKS:

R1 - Luyben W.L., "Process Modeling, Simulation, and Control for Chemical Engineering", McGraw Hill, 2nd Edition, 1990.

R2 - D. F. Rudd and C. C. Watson, "Strategy of Process Engineering", Wiley international, 1st Edition, 1968.

R3 - M.M. Denn, "Process Modelling", Wiley, New York, 1st Edition, 1986.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1	2		2	-	-	1	1	-	2	2	3	3
CO2	2	2	1		1	1	-	1	1	-	1	2	2	2
CO3	3	1	1		-	1	-	-	2	-	1	2	3	3
CO4	2	2	3		1	1	1	2	2	-	1	2	3	3
CO5	2	2	-		1	-	1	2	2	-	1	2	3	3
Avg	2	1.5	1.4		1	1	1	1.5	1.6	-	1.2	2	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN * ENG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5316	Energy Storage Systems	3	0	0	3

Course Objective

The student should be able to

1. Study details of various energy storage systems along with applications.
2. Analyze the operation of different energy storage systems
3. Learn about batteries.
4. Acquire knowledge about Fuel cells.
5. Enabling to identify the optimal solutions to a particular energy storage application/utility

Unit	Description	Instructional Hours
I	**INTRODUCTION** Availability of Energy, Necessity of energy storage, types of energy storage, mechanical, chemical, electrical, electrochemical, biological, magnetic, electromagnetic, thermal, comparison of energy storage technologies	9
II	**ENERGY STORAGE SYSTEMS** Thermal Energy storage, sensible and latent heat, phase change materials, Energy and exergy analysis of thermal energy storage, Electrical Energy storage-super-capacitors, Magnetic Energy storage-Superconducting systems, Mechanical-Pumped hydro, flywheels and pressurized air energy storage	9
III	**ELECTROCHEMICAL ENERGY STORAGE** Battery: fundamentals and technologies, characteristics and performance comparison: Lead-acid, Nickel-Metal hydride, Lithium Ion; Battery system model, emerging trends in batteries. Hydrogen as energy carrier and storage, Hydrogen resources and production	9
IV	**FUEL CELLS** Basic principle of direct energy conversion using fuel cells; Thermodynamics of fuel cells Fuel cell types: AFC, PEMFC, MCFC, SOFC, Microbial Fuel cell; Fuel cell performance, characterization and modeling; Fuel cell system design and technology, applications for power and transportation.	9
V	**APPLICATIONS OF ELECTRICAL ENERGY STORAGE** Renewable energy storage, Battery sizing and stand-alone applications, stationary (Power Grid application), Small scale application: Portable storage systems and medical devices, Mobile storage Applications- Electric vehicles (EVs), types of EVs, batteries and fuel cells, future technologies, hybrid systems for energy storage	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand need of energy storage systems

CO2: Acquire knowledge pertaining to various ways to store energy, its analysis and use.

CO3: Design different energy storage systems

CO4: Determine the operation of fuel cells

CO5: Focus and select efficient energy storage systems for specific applications

TEXT BOOKS:

T1 - Energy Storage - Technologies and Applications by Ahmed Faheem Zobaa, InTech

T2 - Fundamentals of Energy Storage by J. Jensen and B. Sorenson, Wiley-Interscalene, NewYork

REFERENCE BOOKS:

R1 - Thermal energy storage: Systems and Applications by Dincer I. and Rosen M. A., Wiley pub

R2 - Energy Storage: Fundamentals, Materials and Applications, by Huggins R. A., Springer.

R3 - Electric & Hybrid Vehicles by G. Pistoia, Elsevier B. V.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	3	3				-	1	-	-	-	2	3	3
CO2	3	3	3				-	1	-	-	-	2	3	2
CO3	3	3	2				-	1	-	-	-	2	2	2
CO4	3	3	2				-	1	-	-	-	2	3	3
CO5	3	3	3				-	1	-	-	-	2	3	3
Avg	2.8	3	2.6				-	1	-	-	-	2	2.8	2.6

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5302	High Voltage Engineering	3	0	0	3

The student should be able to

Course Objective

1. Describe the various types of over voltages in power system and protection methods.
2. Impart knowledge on nature of breakdown mechanisms in various dielectrics
3. Classify the various generating techniques of high AC, DC and Impulse voltage
4. Summarize the different circuits for high voltage and high current measurement.
5. Explain the high voltage testing of power apparatus and insulation coordination

Unit	Description	Instructional Hours
	OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS	
I	Causes of over voltages and its effects on power system – Lightning phenomenon, switching surges and system faults –control of over voltages due to switching -protection of transmission line against over voltages	9
	ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS	
II	Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Testing of insulating oils – Breakdown mechanisms in solid and composite dielectrics	9
	GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS	
III	Generation of High voltages / currents - DC, AC, impulse voltages and currents. Tripping and control of impulse generators.	9
	MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS	
IV	Measurement of High DC, AC, impulse voltages and currents – cathode ray oscillographs for Impulse voltages and current measurements..	9
	HIGH VOLTAGE TESTING & INSULATION COORDINATION	
V	High voltage testing of electrical power apparatus - Power frequency, impulse voltage and DC testing of Insulators, bushing, circuit breakers, isolators, cables and transformers– Insulation Coordination	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Categorize the various types of over voltages in power system and protection methods.
CO2: Analyze the various breakdown mechanisms in different dielectrics.
CO3: Classify the various generating techniques of high AC, DC and Impulse voltage
CO4: Construct the circuits for high voltage and high current measurement
CO5: Describe the high voltage testing of power apparatus and insulation coordination

TEXT BOOKS:

T1 - M. S. Naidu and V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 6th Edition, 2020.
T2 - E. Kuffel and W. S. Zaengel, "High Voltage Engineering Fundamentals", Pergamon Press, Oxford, London, 2000

REFERENCE BOOKS:

R1 - L.Wadhwa, "High Voltage Engineering", New Age International Publishers,Third Edition,2012
R2 - E. Kuffel and M. Abdullah, "High Voltage Engineering", Pergamon Press, Oxford, 2016..
R3 - Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi, Second Edition, 2013

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	3	3	-	1	-	-	-	-	3	3
CO2	3	3	3	2	2	2	-	1	-	-	-	-	3	2
CO3	3	3	2	3	2	2	-	1	-	-	-	-	2	2
CO4	3	3	2	3	3	2	-	1	-	-	-	-	3	3
CO5	3	3	3	3	3	3	-	1	-	-	-	-	3	3
Avg	2.8	3	2.6	2.8	2.6	2.4	-	1	-	-	-	-	2.8	2.6

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5305	Special Electrical Machines	3	0	0	3

Course Objective

The student should be able to

1. Identify the special electrical motors for specific applications.
2. Review the basics concept of stepper motor and its applications
3. Understand the concept of the operating principle and characteristics of switched reluctance motors
4. Impact the knowledge on controllers for controlling the speed of permanent magnet brushless D.C. motors.
5. Gain knowledge on the sensorless control of permanent magnet synchronous motors

Unit	Description	Instructional Hours
I	**SPECIAL ELECTRICAL MOTORS** Introduction to Special Electrical Machines - Constructional features and Working Principles: AC series motor - Repulsion motor - Hysteresis motor - Single phase Reluctance Motor - Universal Motor - AC & DC Servo motors – Applications.	9
II	**STEPPER MOTORS** Introduction - Constructional features - Principle of operation - Variable Reluctance motor - Single and multi-stack configurations - Permanent Magnet Stepper Motor - Hybrid Stepper motor - Open loop control of 3 phase VR stepper motor - Torque equations - Microprocessor control of stepper motors - Applications	9
III	**PERMANENT MAGNET BRUSHLESS D.C. MOTORS (PM BLDC)** Permanent Magnet materials - Construction - Electronic Commutation - Principle of Operation – BLDC Square wave Motor - Microprocessor based control of BLDC Motor - DSP based control of BLDC Motor - Applications	9
IV	**PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM)** Principle of operation - EMF and Torque equations - Control of PMSM - Microprocessor based control of PMSM Motor - DSP based control of PMSM Motor - Applications	9
V	**SWITCHED RELUCTANCE MOTORS (SRM)** Introduction - Constructional features - Principle of operation - Characteristics - Power Converters; Two switching devices per phase - (n+1) switching devices and (n+1) diodes – Split-link - C-dump - - Microprocessor based control of SRM drive - Sensor less operation - Applications	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Identify various special electrical motors for specific applications.
CO2: Control the speed of the Stepper motor using an appropriate controller.
CO3: Select an appropriate power converter of Switched Reluctance Motor drive for different applications.
CO4: Develop a speed controller for Brushless DC Motors using microprocessor.
CO5: Elucidate the appropriate Controller in Permanent Magnet Synchronous Motor

TEXT BOOKS:

T1 - E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014..
T2 - K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.

REFERENCE BOOKS:

R1 - R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001
R2 - P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 2182.
R3 - T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 2189.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	2	1	-	1	-	1	3	3
CO2	3	3	3	3	-	-	-	1	-	2	-	3	3	2
CO3	3	3	3	3	-	-	-	1	-	1	-	1	2	2
CO4	3	3	3	3	-	-	-	1	-	3	-	3	3	3
CO5	3	3	3	3	-	-	2	1	-	3	-	3	3	3
Avg	3	3	3	3	-	-	2	1	-	2	-	2.1	2.8	2.6

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5308	Microcontroller Based System Design	3	0	0	3

Course Objective

The student should be able to

1. Infer the fundamental components of the PIC microcontroller.
2. Educate the PIC micro controller Interrupts and Timers.
3. Integrate the concept of peripherals and interfacing of microcontroller-based embedded systems.
4. Propose the architecture of arm processor
5. Introduce the concept of arm organization

Unit	Description	Instructional Hours
I	**INTRODUCTION TO PIC MICROCONTROLLER:** Introduction to PIC Microcontroller – PIC 16C6x and PIC16C7x Architecture – PIC16cxx – Pipelining - Program Memory considerations – Register File Structure -- Instruction Set -- Addressing modes – Simple Operations	9
II	**INTERRUPTS AND TIMER** PIC micro controller Interrupts -- External Interrupts – Timers – Timer modules – Front panel I/O- Soft Keys – State machines and key switches – Display of Constant and Variable strings.	9
III	**PERIPHERALS AND INTERFACING:** I2C Bus for Peripherals Chip Access – Bus operation-- Bus subroutines – Serial EEPROM – Baud rate selection – LCD and keyboard Interfacing – ADC – DAC -- and Sensor Interfacing.	9
IV	**INTRODUCTION TO ARM PROCESSOR:** ARM Architecture – ARM programmer's model – ARM Development tools -- Memory Hierarchy – ARM Assembly Language Programming – Simple Examples – Architectural Support for Operating systems.	9
V	**ARM ORGANIZATION:** 3-Stage Pipeline ARM Organization – 5 Stage Pipeline ARM Organization – ARM Instruction Execution -- ARM Implementation – ARM Instruction Set – ARM coprocessor interface – Embedded ARM Applications	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the working of the architecture for PIC microcontrollers

CO2: Identify the factors for data transfer in interrupts and understand the timer function of PIC microcontroller.

CO3: Observe the peripherals and interfacing of microcontroller-based embedded systems.

CO4: Interpret the ARM Architecture and Assembly Language Programming.

CO5: Employ the role of arm organization

TEXT BOOKS:

T1 - Peatman,J.B., "Design with PIC Micro Controllers"PearsonEducation,3rdEdition, 2004

T2 - Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE BOOKS:

R1 - Mazidi, M.A.,"PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007

R2 - Valder – Perez, "Microcontroller – Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

R3 - C.Ravichandran. M. Arulaalan, "Microcontroller Based System Design," Suchitra Publications,2016..

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	-	1	1	-	-	1	2	3	3
CO2	3	1	3	1	-	-	1	1	-	-	1	3	3	3
CO3	3	2	2	1	-	-	1	2	-	1	1	3	3	3
CO4	3	2	2	1	1	-	1	2	1	-	1	3	3	3
CO5	3	1	2	1	1	1	1	2	1	1	1	3	3	3
Avg	3	1.4	2	1	1	1	1	1.6	1	1	1	2.8	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5311	Automotive Electronics	3	0	0	3

Course Objective

The student should be able to

1. Define basics of automotive and electronics fundamentals.
2. Classify and demonstrate various types of sensors and actuators
3. Interpret the basics of electronics engine control
4. Understand the use of automotive networking
5. Make use of future automotive electronic system

Unit	Description	Instructional Hours
I	**AUTOMOTIVE FUNDAMENTALS OVERVIEW** Evolution of Automotive Electronics, The Engine - Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System- Spark plug, High voltage circuit and distribution, Diesel Engine, Drive Train	9
II	**AUTOMOTIVE SENSORS** Automotive Control System applications of Sensors and Actuators - Variables to be measured, Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS	9
III	**DIGITAL ENGINE CONTROL SYSTEMS** Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control -Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System- Secondary Air Management, Evaporative Emissions Canister Purge,	9
IV	**AUTOMOTIVE NETWORKING** Bus Systems- Classification, Applications in the vehicle, Coupling of networks, Examples of networked vehicles, Buses - CAN Bus, UN Bus, MOST Bus, Bluetooth, Flex Ray, Diagnostic Interfaces. Vehicle Motion Control -Typical Cruise Control System, Digital Cruise Control System,	9
V	**AUTOMOTIVE DIAGNOSTICS** Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems, Occupant Protection Systems -Accelerometer based Air Bag systems. Future Automotive Electronic Systems-Alternative Fuel Engines, Electric and Hybrid vehicles,	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Describe the basics of automobile dynamics and design electronics

CO2: Acquire an overview of automotive components in today's automotive industry.

CO3: Use available automotive sensors and actuators during automotive system design.

CO4: Understand the networking of various modules in automotive systems.

CO5: Design and implement the electronics on future Automotive Electronic Systems.

TEXT BOOKS:

T1 - William B. Ribbens, "Understanding Automotive Electronics", 6th Edition, Elsevier Publishing.

T2 - Robert Bosch GmbH (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley & Sons Inc., 2007..

REFERENCE BOOKS:

R1 - Automobile Electrical & Electronic Equipments - Young, Griffitns - Butterworths, London

R2 - Understanding Automotive Electronics, Wiliam B. Ribbens, 5th Edition, Newnes, Butterworth–Heinemann

R3 - Fundamentals of Automotive Electronics - V.A.W.Hilliers - Hatchin, London

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	3	2	-	-	-	1	-	-	-	3	2
CO2	2	3	3	3	3	-	-	-	1	-	-	-	3	2
CO3	3	3	3	3	3	-	-	-	1	3	-	-	3	2
CO4	3	3	3	3	3	-	-	-	1	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	1	3	-	-	3	3
Avg	2.6	2.6	3	3	2.8	-	-	-	1	3	-	-	3	2.4

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5314	Computer Control of Processes	3	0	0	3

Course Objective

The student should be able to

1. Impart knowledge about the linear time invariant system in discrete State Space form..
2. Familiarize the design Digital controllers
3. Introduce the principles of techniques of DAS, DDC, AI and SCADA.
4. Provide an overview of System identification techniques
5. Explain the design Multi-loop and multivariable controller for multivariable system

Unit	Description	Instructional Hours
I	**ANALYSIS OF DISCRETE DATA SYSTEM** State-space representation of discrete data systems: Selection of sampling process – Selection of sampling period – Review of z-transform – Pulse transfer function – Modified z-transform - Stability of discrete data system – Jury's stability test	9
II	**DESIGN OF DIGITAL CONTROLLER** Digital PID – Position and velocity form – Deadbeat's algorithm – Dahlin's algorithm – Kalman's algorithm - Pole placement controller – Predictive controller.	9
III	**COMPUTER AS A CONTROLLER** Basic building blocks of computer control system – Data acquisition systems – SCADA – Direct digital control – Introduction to AI and expert control system – Case study - Design of computerized multi loop controller.	9
IV	**SYSTEM IDENTIFICATION** Non Parametric methods: Transient Analysis, Frequency analysis, Correlation analysis, Spectral analysis. Parametric methods: Least Square method, Recursive least square method	9
V	**MULTI LOOP REGULATORY CONTROL** Multi-Loop Control: Introduction, Process Interaction, Pairing of Input and Outputs, Relative Gain Array (RGA) - Properties and Application of RGA, Multi-loop PID Controller - Decoupler	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the fundamental principles of Electronic devices

CO2: Apply guidelines for residential wiring and circuit design to create safe and efficient electrical installations, considering equipment positioning and load requirements.

CO3: Evaluate the operational principles of household electrical appliances, enabling informed usage, troubleshooting, and maintenance..

CO4: Analyze the structure and components of power systems, transmission, and distribution.

CO5: Utilize knowledge of electrical energy concepts and tariff calculation methods to assess energy usage, promote energy conservation practices, and make informed decisions regarding residential energy consumption.

TEXT BOOKS:

T1 - P.B. Deshpande, and R.H.Ash, "Computer Process Control", ISA Publication, USA, 1995..

T2 - Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005

REFERENCE BOOKS:

R1 - C.M.Houpis, G.B.Lamount, "Digital Control Systems Theory, Hardware and Software", International Student Edition, McGraw Hill Book Co., 1985.

R2 - Coughanowr, D.R., "Process SystemsAnalysis and Control", McGraw - Hill International Edition, 2004

R3 - Singh, "Computer Aided Process Control", Prentice Hall of India, 2004.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	-	1	1	-		1	2	3	3
CO2	3	1	3	1	-	-	1	1	-		1	3	3	3
CO3	3	2	2	1	-	-	1	2	-	1	1	3	3	3
CO4	3	2	2	1	1	-	1	2	1		1	3	3	3
CO5	3	1	2	1	1	1	1	2	1	1	1	3	3	3
Avg	3	1.4	2	1	1	1	1	1.6	1	1	1	2.8	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5317	Hybrid Energy Technology	3	0	0	3

Course Objective

The student should be able to

1. Provide knowledge about different types of hybrid energy systems.
2. analyze the various electrical Generators used for the Wind Energy Conversion Systems
3. Design the power converters used in SPV Systems.
4. analyze the various power converters used in hybrid energy systems and to understand the importance of standalone and grid-connected operation in Hybrid renewable energy systems
5. analyze the performance of the various hybrid energy systems

Unit	Description	Instructional Hours
I	**INTRODUCTION TO HYBRID ENERGY SYSTEMS** Hybrid Energy Systems – Need for Hybrid Energy Systems – Importance of Hybrid Energy systems – Advantages and Disadvantages - Solar-Wind, Solar-Wind-Diesel, Fuel Cell-Diesel, Micro-Hydel-PV- Operating principles-advantages and applications - Classification of Hybrid Energy systems. Environmental aspects of renewable energy - Impacts of renewable energy generation on the environment - Present Indian and international energy scenario of conventional and renewable energy sources	9
II	**ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS)** Review of reference theory fundamentals –Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).-Case study: Develop a simulation model of WECS--Diesel hybrid model	9
III	**POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS** Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buck boost converters- selection of inverter, battery sizing, array sizing - Analysis of SPV Systems - Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems. Case study: Develop a simulation model of SPV-Diesel hybrid model	9
IV	**ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS** Introduction to Power Converters – Stand-alone Converters -AC-DC-AC converters: Controlled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter – Merits and Limitations. Case study: Develop a simulation of PWM inverters	9
V	**CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS** Hybrid Systems- Range and type of Hybrid systems – Performance Analysis – Cost Analysis - Case studies of Wind-PV-Fuel-cell, Wind-Diesel-PV, Micro-hydel-PV, Biomass-Diesel-Fuel-cell systems.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power

CO2: Select a suitable Electrical machine for Wind Energy Conversion Systems and simulate wind energy conversion system

CO3: Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.

CO4: Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.

CO5: Interpret the hybrid renewable energy systems.

TEXT BOOKS:

T1 -Bahman Zohuri, "Hybrid Energy Systems", Springer, First Edition, 2018

T2 - S.M. Muyeen, "Wind Energy Conversion Systems", Springer First Edition, 2012

REFERENCE BOOKS:

R1 - B.H.Khan "Non-conventional Energy sources", Tata McGraw hill Publishing Company, New Delhi, 2017, 3rd Edition.

R2 - Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 2nd Edition, 2006

R3 - Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	3	-	3	-	-	3	3	3
CO2	3	3	3	-	3	-	3	-	3	-	-	3	3	3
CO3	3	3	3	3	3	-	3	-	3	-	-	3	3	3
CO4	3	3	3	-	3	-	3	-	3	-	-	3	3	3
CO5	3	3	3	3	3	-	3	-	3	-	-	3	3	3
Avg	3	3	3	1.9	2.9		3		3			3	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5303	Smart Grid	3	0	0	3

Course Objective

The student should be able to

1. understand the evolution of Smart and Interconnected energy systems.
2. understand the various challenges and benefits of smart grid and the national and international initiatives taken
3. understand the concepts related with transmission and distribution in smart grid technologies
4. get an insight of the various smart measurement technologies.
5. understand the various computing technologies for Smart Operation of the Grid.

Unit	Description	Instructional Hours
	INTRODUCTION	
I	Evolution of Energy Systems, Concept, Definitions and Need, Difference between Conventional & Smart Grid, Drivers, structures, functions, opportunities, challenges and benefits of Smart Grid, Basics of Micro grid, National and International Initiatives in Smart Grid.	9
	SMART METERING	
II	Introduction to Advanced Metering infrastructure (AMI) - drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Real time management and control, Phasor Measurement Unit (PMU).	9
	SMART GRID TECHNOLOGIES FOR TRANSMISSION SYSTEMS	
III	Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, Wide area Monitoring, Protection and control	9
	SMART GRID TECHNOLOGIES FOR DISTRIBUTION SYSTEMS	
IV	DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Electric Vehicles.	9
	SMART GRID APPLICATIONS	
V	Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Computing technologies for Smart Grid applications (Web Service to CLOUD Computing), Role of big data and IoT, Cyber Security for Smart Grid.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: understand the importance and objectives of Power System Grid.
CO2: know and understand the concept of a smart grid
CO3: identify and discuss smart metering devices and associated technologies
CO4: get an overview of Microgrid and Electric Vehicle Technology
CO5: have an up to date knowledge on the various computing technologies; to understand the role of Big Data and for effective and efficient operation of Smart Grid

TEXT BOOKS:

T1 - Smart Grids Advanced Technologies and Solutions, Second Edition, Edited by Stuart Borlase,CRC, 2018.
T2 - Janaka Ekanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley,2012

REFERENCE BOOKS:

R1 - Ahmed F. Zobaa, Trevor J. Bihl, Big data analytics in future power systems, 1st Edition, CRC press 2018.
R2 - James Momoh ,Smart Grid Fundamentals of Design and Analysis, IEEE press 2012
R3 - Stuart Borlase "Smart Grid : Infrastructure, Technology and Solutions", CRC Press 2012

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	-	-	1	-	-	-	2	3	3
CO2	3	3	2	3	3	-	-	1	-	-	-	2	3	3
CO3	3	3	2	3	3	-	-	1	-	-	-	2	3	3
CO4	3	3	2	3	3	-	-	1	-	-	-	2	3	3
CO5	3	3	2	3	3	-	-	1	-	-	-	2	3	3
Avg	3	3	2	3	3	-	-	1	-	-	-	2	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5306	Power Semiconductor Devices	3	0	0	3

Course Objective

The student should be able to

1. understand details about power semiconductor devices..
2. classify the current controlled devices for power semiconductor devices
3. understand the voltage controlled devices for power semiconductor devices.
4. control thefiring and protecting circuits of Power semiconductor devices.
5. control the Power semiconductor devices in specific applications.

Unit	Description	Instructional Hours
	POWER DIODES	
I	Concept of power switches- Ideal Switch -Power diode-structure, operation and V-I characteristics-rating-Breakdown Voltages Consideration- Depletion layer boundary control- On state losses-switching characteristics- types - Turn on Transient, Turn off Transient- Reverse Recovery – Safe Operating Areas - Series and Parallel operation –Ratings- Modelling and Simulation of Power Diode.	9
	CURRENT CONTROLLED DEVICES	
II	BJT- structure , operation and static characteristics-switching characteristics-Breakdown Voltages - Secondary breakdown- power Darlington - On-state Losses – Safe Operating Areas - Thyristors-structure operation and V-I characteristics -two transistor analogy- gate and switching characteristics-Methods of improving di/dt and dv/dt- rating – types - series and parallel operation - Comparison of BJT and thyristor- steady state and dynamic models of BJT and thyristor	9
	VOLTAGE CONTROLLED DEVICES	
III	Power MOSFETs and IGBTs- construction and Operation- static and switching characteristics - steady state and dynamic models of MOSFET and IGBTs- Safe Operating Areas –Ratings – basics of GTO, MCT and IGCT.	9
	FIRING AND PROTECTING CIRCUITS	
IV	Necessity of isolation - Pulse transformer – Opto-coupler-gate drives circuit-SCR, MOSFET, IGBTs and base driving for power BJT-overvoltage- overcurrent and gate protections – Function and types of Snubber circuits – Snubber circuit for power diode and Thyristor - Design of snubber	9
	THERMAL PROTECTION	
V	Heat transfer-conduction, convection and Radiation-cooling- liquid cooling- vapour phase cooling guidance for heat sink selection-thermal resistance and impedance-electrical analogy of thermal components- heat sink types and design-mounting types	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand structure, Operation and V-I Characteristics of Power devices.
CO2: Develop the steady state and dynamic models of power devices
CO3: Identify the ratings and safe operating areas of the power devices
CO4: Apply suitable Firing, drive and Snubber circuit for power devices
CO5: Infer different Protection techniques of power devices

TEXT BOOKS:

T1 - Mohan,Undeland and Robins,'Power Electronics-Concepts, Applications and Design',John Wiley &Sons, Second Edition, 2000.
T2 - M.H.Rashid, 'Power Electronics Circuits, Devices and Applications', Prentice Hall ofIndia, Third Edition, 2004.

REFERENCE BOOKS:

R1 - B.W Williams 'Power Electronics Circuit Devices and Applications', New York, Halsted Press, 1987..
R2 - M.D.Singh and K.BKhanchandani, 'Power Electronics', Tata McGraw-Hill,2001.
R3 - VedamSubramaniam- "Power Electronics"- New Age International (P) Publishers Ltd. - 2nd Ed., Reprint, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	2	1	1	0	2	0	2	2	3
CO2	3	2	3	3	3	2	1	1	0	3	0	2	2	3
CO3	3	3	3	3	3	2	1	1	0	3	0	2	3	3
CO4	3	3	3	3	3	2	0	1	0	3	0	2	3	3
CO5	3	3	3	3	3	2	0	1	0	3	0	2	3	3
Avg	3	2.6	3	3	3	2	1	1	0	2.8	0	2	2.6	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5309	Software for Embedded Systems	3	0	0	3

Course Objective

The student should be able to

1. understand details about power semiconductor devices.
2. classify the driver circuits and snubber circuits for power semiconductor devices
3. understand different protection circuits for power semiconductor devices.
4. control the Power semiconductor devices in specific applications.
5. control the Power semiconductor devices in specific applications.

Unit	Description	Instructional Hours
	POWER DIODES	
I	Concept of power switches- Ideal Switch -Power diode-structure, operation and V-I characteristics-rating-Breakdown Voltages Consideration- Depletion layer boundary control- On state losses-switching characteristics- types - Turn on Transient, Turn off Transient- Reverse Recovery – Safe Operating Areas - Series and Parallel operation –Ratings- Modelling and Simulation of Power Diode.	9
	CURRENT CONTROLLED DEVICES	
II	BJT- structure , operation and static characteristics-switching characteristics-Breakdown Voltages - Secondary breakdown- power Darlington - On-state Losses – Safe Operating Areas - Thyristors-structure operation and V-I characteristics -two transistor analogy- gate and switching characteristics-Methods of improving di/dt and dv/dt- rating – types - series and parallel operation - Comparison of BJT and thyristor- steady state and dynamic models of BJT and thyristor	9
	VOLTAGE CONTROLLED DEVICES	
III	Power MOSFETs and IGBTs- construction and Operation- static and switching characteristics - steady state and dynamic models of MOSFET and IGBTs- Safe Operating Areas –Ratings – basics of GTO, MCT and IGCT.	9
	FIRING AND PROTECTING CIRCUITS	
IV	Necessity of isolation - Pulse transformer – Opto-coupler-gate drives circuit-SCR, MOSFET, IGBTs and base driving for power BJT-overvoltage- overcurrent and gate protections – Function and types of Snubber circuits – Snubber circuit for power diode and Thyristor - Design of snubber	9
	THERMAL PROTECTION	
V	Heat transfer-conduction, convection and Radiation-cooling- liquid cooling- vapour phase cooling guidance for heat sink selection-thermal resistance and impedance-electrical analogy of thermal components- heat sink types and design-mounting types	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand structure, Operation and V-I Characteristics of Power devices.
CO2: Develop the steady state and dynamic models of power devices
CO3: Identify the ratings and safe operating areas of the power devices
CO4: Apply suitable Firing, drive and Snubber circuit for power devices
CO5: Infer different Protection techniques of power devices

TEXT BOOKS:

T1 - Mohan,Undeland and Robins,'Power Electronics-Concepts, Applications and Design'.John Wiley &Sons, Second Edition, 2000.
T2 - M.H.Rashid, 'Power Electronics Circuits, Devices and Applications', Prentice Hall oflndia, Third Edition, 2004.

REFERENCE BOOKS:

R1 - B.W Williams 'Power Electronics Circuit Devices and Applications', New York, Halsted Press, 1987..
R2 - M.D.Singh and K.BKhanchandani, 'Power Electronics', Tata McGraw-Hill,2001.
R3 - VedamSubramaniam- "Power Electronics"- New Age International (P) Publishers Ltd. - 2nd Ed., Reprint, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3	2	1	1	0	2	0	2	2	3
CO2	3	2	3	3	3	2	1	1	0	3	0	2	2	3
CO3	3	3	3	3	3	2	1	1	0	3	0	2	3	3
CO4	3	3	3	3	3	2	0	1	0	3	0	2	3	3
CO5	3	3	3	3	3	2	0	1	0	3	0	2	3	3
Avg	3	2.6	3	3	3	2	1	1	0	2.8	0	2	2.6	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5312	Design of Motor and Power Converters for Electric Vehicles	3	0	0	3

Course Objective

The student should be able to

1. Understand the drive cycles and requirements of EVs
2. Recall the working of motors used in Electric Vehicle
3. Analyze and model the buck/boost converter operation and to design the same
4. Develop the simulation basics of control systems.
5. Compute the transfer functions for DC-DC converters.

Unit	Description	Instructional Hours
I	**ELECTRIC VEHICLE DYNAMICS** Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed, torque, power, energy requirements of EVs.	9
II	**MOTORS FOR ELECTRIC VEHICLES** Introduction – Speed And Torque control of above and below rated speed-Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs). Synchronous Reluctance Machines	9
III	**BASICS OF SIMULATION IN CONTROL SYSTEMS** Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions), state space modelling	9
IV	**MODELING OF DC-DC CONVERTERS** Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling - Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter	9
V	**POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS** Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Use appropriate electric machine for electric vehicle application.

CO2: Compute transfer function with factors such as constant, integral, differential, first order factor and second order factor

CO3: Compute transfer function from state models

CO4: Design buck, boost and buck-boost converter

CO5: Simulate DC-DC converters and to obtain gain margin and phase margin

TEXT BOOKS:

T1 - Ali Emadi, Handbook of Automotive Power Electronics and Motor Drives, Taylor & Francis, 2005,1st Edition

T2 - Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Third Edition 2021

REFERENCE BOOKS:

R1 - P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2003

R2 - Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK, , Wiley,2021, 1st Edition

R3 - Md. Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control, CRC Press,2021, 1st Edition

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	1	-	3	-	3	2	3
CO2	3	3	3	3	3	-	-	1	-	3	-	3	2	3
CO3	3	3	3	3	3	-	-	1	-	3	-	3	3	3
CO4	3	3	3	3	3	-	-	1	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	1	-	3	-	3	3	3
Avg	3	3	3	3	3	-	-	1	-	3	-	3	2.6	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5315	MODEL BASED CONTROL	3	0	0	3

Course Objective

The student should be able to

1. Impart knowledge about System and to introduce dynamics of various processes..
2. Familiarize the effect of various control actions
3. Introduce the principles of on the final control elements.
4. Provide an overview of evaluation criteria and tuning techniques of controllers.
5. Explain the concepts of concept of multi loop control techniques.

Unit	Description	Instructional Hours
I	**PROCESS DYNAMICS** Need for process control – Mathematical model of Flow, Level, Pressure and Thermal processes – Interacting and non-interacting systems – Degrees of freedom – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR – Linearization of nonlinear systems..	9
II	**CONTROL ACTIONS** Characteristic of on-off, proportional, single speed floating, integral and derivative controllers – P+I, P+D and P+I+D control modes – Electronic PID controller – Auto/manual transfer - Reset windup – Practical forms of PID Controller.	9
III	**FINAL CONTROL ELEMENTS** I/P converter - Pneumatic and electric actuators – Valve Positioner – Control Valves – Characteristic of ControlValves:- Inherent and Installed characteristics – Modeling of pneumatic control valve – Valve body:-Commercial valve bodies – Control valve sizing – Cavitation and flashing – Selection criteria.	9
IV	**CONTROLLER TUNING** Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio - Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method – Determination of optimum settings for mathematically described processes using time response and frequency response approaches – Auto tuning	9
V	**MULTILOOP CONTROL** Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Examples from distillation column and boiler systems – IMC– Model Predictive Control – Adaptive control – P&ID diagram.	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the fundamental principles of Electronic devices

CO2: Apply guidelines for residential wiring and circuit design to create safe and efficient electrical installations, considering equipment positioning and load requirements

CO3: Evaluate the operational principles of household electrical appliances, enabling informed usage, troubleshooting, and maintenance.

CO4: Analyze the structure and components of power systems, transmission, and distribution

CO5: Utilize knowledge of electrical energy concepts and tariff calculation methods to assess energy usage, promote energy conservation practices, and make informed decisions regarding residential energy consumption.

TEXT BOOKS:

T1 - Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004..

T2 - Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005

REFERENCE BOOKS:

R1 - Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003

R2 - Coughanowr, D.R., "Process SystemsAnalysis and Control", McGraw - Hill International Edition, 2004.

R3 - D. P. Eckman, "Automatic Process control", 7 th Edition, John Wiley, New York, 1990

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	1	-	3	-	3	2	3
CO2	3	3	3	3	3	-	-	1	-	3	-	3	2	3
CO3	3	3	3	3	3	-	-	1	-	3	-	3	3	3
CO4	3	3	3	3	3	-	-	1	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	1	-	3	-	3	3	3
Avg	3	3	3	3	3	-	-	1	-	3	-	3	2.6	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / V	22EE5318	DESIGN AND MODELING OF RENEWABLE ENERGY SYSTEMS	3	0	0	3

Course Objective

The student should be able to

1. review the renewable energy systems and technology.
2. learn the single phase grid-connected photovoltaic systems
3. learn the three phase grid-connected photovoltaic systems.
4. illustrate the small wind energy systems.
5. simulate the Doubly-fed induction generator based WECS

Unit	Description	Instructional Hours
I	**RENEWABLE ENERGY SYSTEMS TECHNOLOGY OVERVIEW AND PERSPECTIVES** Introduction-State of the Art- Examples of Recent Research and Development Challenges and Future Trends-IoT, Artificial Intelligence(AI) and Machine Learning	9
II	**SINGLE-PHASE GRID-CONNECTED PHOTOVOLTAIC SYSTEMS:** Introduction- Demands for Grid-Connected PV Systems-Power Converter Technology for Single Phase PV Systems, Transformer less AC-Module Inverters (Module-Integrated PV Converters, Transformer less Single-Stage String Inverters, DC-Module Converters in Transformer less Double-Stage PV Systems. Case Study: Develop a Simulation ofsingle phase inverter for PV systems	9
III	**THREE-PHASE PHOTOVOLTAIC SYSTEMS: STRUCTURES, TOPOLOGIES:** Introduction-PV Inverter Structures, Three-Phase PV Inverter Topologies- -Control Building Blocks for PV Inverters, Modulation Strategies for Three-Phase PV Inverters, Implementation of the Modulation Strategies., Grid Synchronization, Implementation of the PLLs for Grid Synchronization-Maximum Power Point Tracking. Case Study: Develop a Simulation of three phase inverter for PV systems	9
IV	**SMALL WIND ENERGY SYSTEMS:** Introduction-Generator Selection for Small-Scale Wind Energy Systems- Turbine Selection for Wind Energy- Self-Excited Induction Generators for Small Wind Energy Applications- Permanent Magnet Synchronous Generators for Small Wind Power Applications- Grid-Tied Small Wind Turbine Systems-Magnus Turbine–Based Wind Energy System. Case study: Develop a simulation model of Simulation of WECS	9
V	**DOUBLY-FED INDUCTION GENERATOR-BASED WECS** Introduction – modelling of induction machine in machine variable form and arbitrary reference frame, modelling of Doubly-fed Induction Generator.Case study: Develop a simulation model of Simulation of WECS with DFIG	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Review the perspectives of renewable energy systems
CO2: Integrate photovoltaic systems with grid.
CO3: Study inverter for PV systems..
CO4: Elaborate the working of small wind power systems
CO5: Study the features of induction machine and doubly fed induction machine.

TEXT BOOKS:

T1 - Ahmad Azar, Nashwa Kamal, "Design, Analysis and Applications of Renewable Energy Systems", Academic Press, First Edition, 2021..

T2 - Md. Rabiul Islam, Md. Rakibuzzaman Shah, Mohd Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", CRC Press, First Edison, 2021

REFERENCE BOOKS:

R1 - .H.Khan "Non-conventional Energy sources", Tata McGraw hill Publishing Company, New Delhi, 2017, 3rd Edition

R2 - Renewable Energy Devices and Systems with Simulations in MATLAB and ANSYS, Frede Blaabjerg, Dan M. Ionel, CRC press, 2017, 1st Edition.

R3 - Wind Power Integration - Connection and System Operational Aspects, Brendan Fox, 2014, IET, 2nd Edition

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	3	-	3	-	-	3	3	3
CO2	3	3	3	-	3	-	3	-	3	-	-	3	3	3
CO3	3	3	3	2	3	-	3	-	3	-	-	3	3	3
CO4	3	3	3	2	3	-	3	-	3	-	-	3	3	3
CO5	3	3	3	2	3	-	3	-	3	-	-	3	3	3
Avg	3	3	3	2.1	2.5	-	3	-	3	-	-	3	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

2022 Regulation – 2022 Batch V semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
NIL						

New Course Introduced (2022 Regulation) – 2022 Batch V semester

S.No	Regulation	Course Code with Name	Credits
1.	2022	22EE5201 – Electrical Machines -II	3
2.	2022	22EE5202 – Microprocessors and Microcontrollers	3
3.	2022	22EI5251 – Control Systems	4
4.	2022	22EE5001 – Electrical Machines –II Laboratory	1.5
5.	2022	22EE5002 – Microprocessors and Micro controllers Laboratory	1.5
6.	2022	22EE5301- Flexible AC Transmission Systems	3
7.	2022	22EE5302-High Voltage Engineering	3
8.	2022	22EE5303-Smart Grid	3
9.	2022	22EE5304-Design of Electrical Machines	3
10.	2022	22EE5305-Special Electrical Machines	3
11.	2022	22EE5306-Power Semiconductor Devices	3
12.	2022	22EE5307-Embedded System	3
13.	2022	22EE5308-Microcontroller Based System Design	3
14.	2022	22EE5309-Software for Embedded Systems	3
15.	2022	22EE5310-Electric Vehicle Architecture	3
16.	2022	22EE5311-Automotive Electronics	3
17.	2022	22EE5312-Design of Motor and Power Converters for Electric Vehicles	3
18.	2022	22EE5313-Process Modeling and Simulation	3
19.	2022	22EE5314-Computer Control of Processes	3
20.	2022	22EE5315-Model Based Control	3
21.	2022	22EE5316-Energy Storage Systems	3
22.	2022	22EE5317-Hybrid Energy Technology	3
23.	2022	22EE5318-Design and Modelling of Renewable Energy Systems	3

Chairman-BoS
Chairman - BoS
EEE - HiCET

Dean Academics
Dean (Academics)
HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING (UG)

REGULATION-2019

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1103	Calculus and Differential Equations	BS	3	1	0	4	40	60	100
THEORY WITH LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21HE1071	Language Competency Enhancement Course-I	HS	0	0	2	1	0	100	100
MANDATORY COURSES										
8	21HE1072	**Career Guidance Level – I** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
9	21HE1073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
			Total :	**15**	**2**	**12**	**20**	**450**	**450**	**900**
As Per AICTE Norms 3 Weeks Induction Programme is Added in the First Semester as an Audit Course										

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2	21MA2102	Complex Variables and Transform Calculus	BS	3	1	0	4	40	60	100
THEORY WITH LAB COMPONENT										
3	21PH2151	Material Science	BS	2	0	2	3	50	50	100
4	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
5	21EE2151	Circuit Theory	ES	2	0	2	3	50	50	100
6	21CS2152	Essentials of C and C++ Programming	ES	2	0	2	3	50	50	100
PRACTICAL										
7	21ME2001/ 21EE2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	21HE2071	Language Competency Enhancement Course-II	HS	0	0	2	1	0	100	100
MANDATORY COURSES										
9	21HE2072	**Career Guidance Level –II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
			Total :	**15**	**2**	**14**	**22**	**400**	**500**	**900**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3102	Fourier Analysis and Transforms	BS	3	1	0	4	40	60	100
2	21EE3201	Electronic Devices and Circuits	PC	3	1	0	4	40	60	100
3	21EE3202	Electrical Machines I	PC	3	0	0	3	40	60	100
4	21EE3231	Field Theory	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21EE3251	Electrical and Electronic Measurements	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21EE3001	Electronic Devices and Circuits Laboratory	PC	0	0	3	1.5	60	40	100
7	21EE3002	Electrical Machines Laboratory I	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21MC3191	Indian Constitution	MC	2	0	0	0	100	0	100
9	21HE3072	**Career Guidance Level – III**	EEC	2	0	0	0	100	0	100

		Personality, Aptitude and Career Development								
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
			Total	**19**	**2**	**8**	**20**	**550**	**450**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA4101	Numerical Methods	BS	3	1	0	4	40	60	100
2	21EE4201	Electrical Machines II	PC	3	1	0	4	40	60	100
3	21EE4202	Integrated Circuits and Its Applications	PC	3	0	0	3	40	60	100
4	21EE4203	Digital Signal Processing	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21EE4251	Digital Logic Circuits	PC	2	1	2	4	50	50	100
PRACTICAL										
6	21EE4001	Electrical Machines Laboratory II	PC	0	0	3	1.5	60	40	100
7	21EE4002	Integrated Circuits Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21MC4191	Essence of Indian tradition knowledge/Value Education	MC	2	0	0	0	100	0	100
9	21HE4072	**Career Guidance Level –IV** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100
			Total	**20**	**3**	**8**	**21**	**550**	**450**	**1000**

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21EE5201	Design of Electrical Machines	PC	3	0	0	3	40	60	100
2	21EE5202	Renewable and Non-Renewable Energy Sources	PC	3	1	0	4	40	60	100
3	21EE5203	Microprocessors and Microcontrollers	PC	3	0	0	3	40	60	100
4	21EE5204	Transmission and Distribution	PC	3	0	0	3	40	60	100

5	21EE53XX	**Professional Elective -I**	PE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
6	21EE5251	Control Systems Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21EE5001	Control and Instrumentation Laboratory	PC	0	0	3	1.5	60	40	100
8	21EE5002	Microprocessors and Microcontrollers Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
			Total	**19**	**1**	**8**	**24**	**475**	**525**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21EE6181	Industrial Safety Management	HS	3	0	0	3	40	60	100
2	21EE6201	Power Electronics	PC	3	0	0	3	40	60	100
3	21EE6202	Power System Analysis	PC	3	0	0	3	40	60	100
4	21EE63XX	**Professional Elective - II**	PE	3	0	0	3	40	60	100
5	21XX64XX	**Open Elective– I**	OE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
6	21EE6251	Embedded Systems	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21EE6001	Power Electronics Laboratory	PC	0	0	3	1.5	60	40	100
8	21EE6002	Control Wiring and Circuit Design Laboratory	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
9	21EE6701	Internship Training	EEC	0	0	0	1	0	100	100
10	21HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
11	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
			Total	**19**	**0**	**8**	**24**	**475**	**625**	**1100**

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21EE7201	Solid State Drives	PC	3	0	0	3	40	60	100
2	21EE7202	Protection and Switchgears	PC	3	0	0	3	40	60	100
3	21EE73XX	Professional Elective- III	PE	3	0	0	3	40	60	100
4	21XX74XX	**Open Elective – II**	OE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21EE7251	Power System Operation and Control	PC	2	0	2	3	50	50	100
PRACTICALS										
6	21EE7001	Control Wiring and Circuit Design Laboratory	PC	0	0	3	1.5	60	40	100
7	21EE7002	Power System Simulation Laboratory	PC	0	0	3	1.5	60	40	100
PROJECT WORK										
8	21EE7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
			Total	**14**	**0**	**12**	**20**	**380**	**520**	**800**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21EE83XX	**Professional Elective –IV**	PE	3	0	0	3	40	60	100
2	21EE81XX	**Professional Elective- V**	PE	3	0	0	3	40	60	100
PROJECT WORK										
3	21EE8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
			Total	**6**	**0**	**16**	**14**	**150**	**250**	**400**

TOTAL NO OF CREDITS: 165

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21EE5301	Fibre Optics and Laser Instruments	PE	3	0	0	3	40	60	100
2	21EE5302	Biomedical Instrumentation	PE	3	0	0	3	40	60	100
3	21IT5331	Fundamentals of Java Programming	PE	3	0	0	3	40	60	100
4	21EE5304	Computer Networks	PE	3	0	0	3	40	60	100
5	21EE5305	Control of Electrical Apparatus	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II										
1	21EE6301	Industrial Automation	PE	3	0	0	3	40	60	100
2	21EE6302	Electric Vehicle Mechanics and Control	PE	3	0	0	3	40	60	100
3	21EE6303	Flexible AC Transmission Systems	PE	3	0	0	3	40	60	100
4	21EE6304	Electrical Estimation and Costing	PE	3	0	0	3	40	60	100
5	21EE6305	Principles of Robotics	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE III										
1	21EE7301	High Voltage Engineering	PE	3	0	0	3	40	60	100
2	21EE7302	Electrical Energy Utilization and Conservation	PE	3	0	0	3	40	60	100
3	21EE7303	Internet of Things	PE	3	0	0	3	40	60	100
4	21EE7304	Nano Technology	PE	3	0	0	3	40	60	100
5	21EE7305	Wireless Sensor Network	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE IV										
1	21EE8301	Special Electrical Machines	PE	3	0	0	3	40	60	100
2	21EE8302	Microcontroller Based System Design	PE	3	0	0	3	40	60	100
3	21EE8303	Smart Grid	PE	3	0	0	3	40	60	100
4	21EE8304	Advanced Soft Computing	PE	3	0	0	3	40	60	100
5	21EE8305	Power Quality	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE V										
1	21EE8306	Preventive Maintenance of Electrical Apparatus	PE	3	0	0	3	40	60	100
2	21EE8307	High Voltage Direct Current Transmission	PE	3	0	0	3	40	60	100
3	21EE8308	Energy Auditing and Energy Management	PE	3	0	0	3	40	60	100
4	21EE8309	Application of Power Electronics For Renewable Energy Systems	PE	3	0	0	3	40	60	100
5	21EE8310	Intellectual Property Rights	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVES										
S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
1	21EE6401	Fundamentals of Solar Photo Voltaic systems	OE	3	0	0	3	40	60	100
2	21EE7401	Electric Vehicles	OE	3	0	0	3	40	60	100

Enrolment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree. For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10 of Regulation 2022 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree(Optional).

VERTICALS FOR MINOR DEGREE

- Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

Note: Each programme should provide verticals for minor degree –

ELECTRICAL AND ELECTRONICS ENGINEERING OFFERING

MINOR DEGREE: RENEWABLE ENERGY ENGINEERING

S No	Course Code	Course Title	Category	Periods Per week			Credits
				L	T	P	
1.	21EE5601	Sem 5:Introduction to Energy Studies	MDC	3	0	0	3
2.	21EE6601	Sem 6:Renewable Energy Systems	MDC	3	0	0	3
3.	21EE6602	Sem 6:Solar photovoltaic Fundamentals and Its Applications	MDC	3	0	0	3
4.	21EE7601	Sem 7:Wind Energy Conversion System	MDC	3	0	0	3
5.	21EE7602	Sem 7:Energy Storage Systems	MDC	3	0	0	3
6.	21EE8601	Sem 8: Power plant Instrumentation	MDC	3	0	0	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

B.E (Hons) Electrical and Electronics Engineering with Specialization in Energy engineering

S.NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TCP	CIA	ESE	TOTAL
				L	T	P	C				
1.	21EE5206	Sem 5:Energy Management & Auditing	PC	3	0	0	3	4	40	60	100
2.	21EE6205	Sem 6 Advanced Power Plant Engineering:	PC	3	0	0	3	4	40	60	100
3.	21EE6206	Sem 6:Instrumentation for Energy Systems	PC	3	0	0	3	3	40	60	100
4.	21EE7205	Sem 7:Energy Conversion Techniques	PC	3	0	0	3	4	40	60	100
5.	21EE7206	Sem 7:Electric vehicle Machines and Drives	PC	3	0	0	3	4	40	60	100
6.	21EE8202	Sem 8:Solar Energy Technologies	PC	3	0	0	3	4	40	60	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

Legends

BS – Basic Science Course

HS – Humanities and Social Science including Management Course

ES – Engineering Science Course

PC – Professional Core Course

PE – Professional Elective Course

OE – Open Elective Course

VA – Value Added Course

MC – Mandatory Course

EEC – Employability Enhancement Courses

CIA – Continues Internal Assessment

ESE – End Semester Examinations

Chairman-BoS

Chairman - BoS
EEE - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7201	Solid State Drives	3	0	0	3

Course Objective

The student should be able to

1. Understand steady state operation and transient dynamics of a motor load system..
2. Analyze and design the speed controllers for a closed loop solid state DC motor drive
3. Recall and analyze the operation of the converter/chopper fed dc drive, both qualitatively and Quantitatively
4. Study and understand the operation and performance of AC motor drives
5. Design the speed controllers for induction motor control.

Unit	Description	Instructional Hours
I	**DRIVE MOTOR CHARACTERISTICS** Electric drives and advantages – Equations governing motor load dynamics – steady state stability – multi quadrant operation – modes of operation: steady state, acceleration, deceleration, starting & stopping – Typical load torque characteristics – choice of electrical drives	9
II	**DC MOTOR DRIVES** Steady state analysis of the single phase and three phase converter fed separately excited DC motor drives– Ward Leonard Drives – chopper control of separately excited DC motor	9
III	**INDUCTION MOTOR DRIVES** Stator voltage control–Cyclo converter control of induction motor - voltage and current fed inverter control– closed loop speed control – static rotor resistance control-V/F Control of Induction Motor and qualitative treatment of slip power recovery drives.	9
IV	**SYNCHRONOUS MOTOR DRIVES** V/f control and self-control of synchronous motor: margin angle control and power factor control – CSI fed synchronous motor drive with forced commutation – permanent magnet synchronous motor-Brushless DC motor.	9
V	**DESIGN OF CONTROLLERS FOR DRIVES** Design of controllers for linearly and exponential varying inputs – phase margin optimum control – magnitude optimum control – symmetrical optimum control – Application of P, I, D, PI, PD, and PID controller to drive.	9
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to
CO1: Analyze the stability of the system depending on load.
CO2: Identify the type of electric motor applicable for various applications
CO3: Analyze the operation of the converter and chopper fed dc drive
CO4: Design the speed controllers for a closed loop solid state DC motor drives
CO5: Design the speed controllers for induction motors to control and maintain the speed

TEXT BOOKS:

T1 - P.C. Sen Principles of Electric Machines and Power Electronics,3rd Edition Wiley publication,2013
T2 - Vedam Subramanyam, "Electric Drives concepts and applications", Tata McGraw Hill, 2007...

REFERENCE BOOKS:

R1 - .K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 2013
R2 - Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002
R3 - John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1		1	1			2	2	3	3
CO2	3	3	2	2	2		2	1			2	3	3	3
CO3	3	3	2	2	2		1	2		1	2	3	3	3
CO4	3	2	3	3	1	2	1	2	1		2	3	3	3
CO5	3	2	3	3	1	2	1	2	1		2	3	3	3
Avg	3	2.6	2.4	2.4	1.4	2	1.2	1.6	1	1	2	2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7202	Protection and Switchgear	3	0	0	3

Course Objective

The student should be able to

1. Educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
2. Construction ,operation and characteristics of various electromagnetic relays
3. Describe the various protection of apparatus
4. Understanding arc quenching theories of various circuit breakers
5. Impart knowledge on functioning of circuit breakers

Unit	Description	Instructional Hours
I	**PROTECTION SCHEMES** Essential requirements of Protection – nature and causes of faults – types of faults — Zones of protection and essential qualities of protection – Protection schemes-protection against over voltages due to lightning /switching transients	9
II	**ELECTROMAGNETIC RELAYS** Operating principles of relays - the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Introduction to numerical relays- essential of numerical relay-working of numerical relay and its types –earth fault relay- Motor Protection relay-cable differential relays	9
III	**APPARATUS PROTECTION** Current transformers (CT) and Potential transformers (PT) and their applications in protection schemes - Protection of transformer, generator, motor, bus-bars and transmission line- numerical relay-protection schemes for over current and distance protection of transmission line.	9
IV	**THEORY OF ARC QUENCHING** Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping – Capacitive current breaking	9
V	**CIRCUIT BREAKERS** Classification of circuit breakers – air circuit breakers, SF6 and vacuum circuit breakers -Gound Fault circuit interrupter(GFCI) and Arc Fault Circuit breaker (AFCB)-MCB, MCCB and characteristics curves of MCB and MCCB-Programmable relay and breakers – comparison of different circuit breakers –testing of Circuit breakers	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Analyze the causes of faults in electrical apparatus and power system.
CO2: Evaluate the characteristics and function of relays
CO3: To gain knowledge the various apparatus protection techniques and their applications
CO4: Solve the problems associated with the circuit interruptions by circuit breakers
CO5: Classify the types of circuit breaker and their testing

TEXT BOOKS:

T1 - Badri Ram ,B.H. Vishwakarma, Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011

T2 - Y.G.Paithankar and S.R.Bhide, Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2010.

REFERENCE BOOKS:

R1 - . C.L.Wadhwa, E lectrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010

R2 - Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

R3 - V.K.Mehta and Rohit Mehta,Principles of Power System,S.Chand & Company Pvt.Ltd.,New Delhi

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1				1			1	2	3	3
CO2	3	3	1	1				1			1	3	3	3
CO3	3	3	1	1				1		1	1	3	3	3
CO4	3	2	3	1		1		1	1		1	3	3	3
CO5	3	2	3	1		1		1	1		1	3	3	3
Avg	3	2.6	1.8	1		1		1	1	1	1	2.8	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7251	Power System Operation and Control	2	0	2	3

Course Objective

The student should be able to

1. Overview of power system operation and control.
2. Model power-frequency dynamics and to design power-frequency controller.
3. Model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4. Study the economic operation of power system.
5. Teach about SCADA and its application for real time operation and control of power systems

Unit	Description	Instructional Hours
I	**INTRODUCTION** An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curves –**Simulation of daily load curve**	6+3
II	**REAL POWER - FREQUENCY CONTROL** Basics of speed governing mechanism and modeling – control area concept - LFC control of a single-area system – Modelling- response –two area system- **Simulink model of Load Frequency Control of single area power system.**	6+3
III	**REACTIVE POWER–VOLTAGE CONTROL** Generation and absorption of reactive power - Excitation systems-modeling - methods of voltage control: Shunt capacitors, Series capacitors and Shunt Reactors – **Simulink model of Tap-Changing transformer.**	6+3
IV	**ECONOMIC LOAD DISPATCH AND UNIT COMMITMENT** Formulation of economic dispatch problem - co-ordination equations - λ-iteration method - statement of unit commitment problem. **Simulation of Economic Load Dispatch without considering losses.**	6+3
V	**COMPUTER CONTROL OF POWER SYSTEMS** Concept of energy control center - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA - state transition diagram showing various state transitions and control strategies. **Experimental study of Electromagnetic Transients in power systems**	6+3
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Interpret the overview of power system operations.
CO2: Analysis the single area system using frequency control.
CO3: Summarize the various voltage control methods of power system.
CO4: Solve the economic load dispatch and optimum unit commitment for a power system.
CO5: Illustrate the functional content of SCADA and related systems.

TEXT BOOKS:

T1 - Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', 3rd edition, John Wiley & Sons, Inc.,2013.
T2 - Olle.I.Elgerd, 'Electric Energy Systems Theory An Introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010

REFERENCE BOOKS:

R1 - V. K. Mehta and R. Mehta, Principles of Power Systems, S. Chand Publishing, New Delhi 24th edition,2009.
R2 - Nagrath I.J. and Kothari D.P., Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011
R3 - KundurP.,Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2			1	1			1	2	3	3
CO2	3	3	2	2			1	1			1	3	3	3
CO3	3	3	2	2			1	2		1	1	3	3	3
CO4	3	3	2	2		1	1	2	1		1	3	3	3
CO5	3	3	2	2		2	1	2	1		1	3	3	3
Avg	3	2.8	2	2		1.5	1	1.6	1	1	1	2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE	21EE7001	Control Wiring and Circuit Design Laboratory	0	0	3	1.5

Course Objective

1. Develop control circuits to control and protect the induction motor.
2. Conduct experiments to prevent single phasing and reversal of motor.
3. Test the Control circuits for different ac starter.
4. Develop the voltage control circuits using Solid state Components.
5. Understand and analyze the working of Inverter.

S. No.	Description of the Experiments
1.	Construct and test the control circuit for dynamic braking of cage motor.
2.	Construct and test the control circuit for jogging in cage induction motor.
3.	Develop and test the control circuit for single phase preventer.
4.	Develop and test the control circuit for forward and reverse operation of a motor.
5.	Construct a control Circuit to safely start a Single phase Motor.
6.	Devise and test the control circuit for automatic star –delta starter for cage Induction Motor.
7.	Test the control circuit for rotor resistance starter for Slip ring Induction Motor.
8.	Test the Voltage control Circuit for Speed control of AC motor using SCR /MOSFET.
9.	Construct and test the design of the fixed dc power supply for various applications using LM7805.
10.	Construct and test the design of the variable dc power supply for various applications using LM317.
11.	Design and estimate the Solar based Inverter.

Total Practical Hours 45

Course Outcome

CO1: Construct and test the different control circuits of induction motor.
CO2: Provide control circuit for single phasing and reversal of motor.
CO3: Experimentally verify the control circuit for starters.
CO4: Develop the voltage control circuits using electronic components.
CO5: Understand the various components and working of an inverter.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1		1	1	1		2	2	3	3
CO2	3	3	3	3	1		2	1	1		2	3	3	3
CO3	3	3	3	3	1		1	1	1	1	2	3	3	3
CO4	3	3	3	3	1	1	1	1	1		2	3	3	3
CO5	3	3	3	3	1	1	1	1	1		2	3	3	3
Avg	3	3	3	3	1	1	1.2	1	1	1	2	2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH *
Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
BE	21EE7002	Power System Simulation Laboratory	0	0	3	1.5

Course Objective

To assist the students to acquire power system software development skills and experience in the usage of standard packages necessary for

1. Computation of line parameters and modeling of transmission lines.
2. Formation of Bus impedance and admittance matrices.
3. Simulation of Economic Load Dispatch and Load Frequency of Dynamics of power system.
4. Load flow analysis using GS and NR method of power System.
5. Fault analysis for balanced and unbalanced faults in Power system.

S.No	Description of the Experiments
1.	Computation of Transmission line parameters.
2.	Modeling and performance of Transmission lines.
3.	Formation of Bus Admittance Matrices.
4.	Formation of Bus Impedance Matrices.
5.	Economic Load Dispatch considering losses.
6.	Load Frequency Dynamics of Two Area Power Systems.
7.	Load Flow Analysis: Solution of Load Flow and Related Problems Using Gauss-Seidel method.
8.	Load Flow Analysis: Solution of Load Flow and similar Problems Using Newton-Raphson method.
9.	Fault Analysis- Symmetrical Fault.
10.	Fault Analysis- Unsymmetrical Fault.

Total Instructional Hours 45

Course Outcome

CO1: Realize the skills acquired in the previous semesters to solve complex engineering problems.
CO2: Build up an innovative model / prototype of an idea related to the field of specialization.
CO3: Create the work individually to identify, troubleshoot and build products for environmental and Societal issues.
CO4: Effective presentation of ideas with clarity.
CO5: Evaluate surveys towards developing a product which helps in life time learning.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1		1	1			2	2	3	3
CO2	3	2	2	2	2		2	1			2	3	3	3
CO3	3	2	2	2	2		1	2		1	2	3	3	3
CO4	3	2	2	2	1	2	1	2	1		2	3	3	3
CO5	3	2	2	2	1	2	1	2	1		2	3	3	3
Avg	3	2	2	2	1.4	2	1.2	1.6	1	1	2	2.8	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * MINDSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

PROFESSIONAL ELECTIVE-III

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7301	High Voltage Engineering	3	0	0	3

The student should be able to

Course Objective

1. Describe the various types of over voltages in power system and protection methods.
2. Impart knowledge on nature of breakdown mechanisms in various dielectrics.
3. Classify the various generating techniques of high AC, DC and Impulse voltage.
4. Summarize the different circuits for high voltage and high current measurement.
5. Explain the high voltage testing of power apparatus and insulation coordination

Unit	Description	Instructional Hours
I	**OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS** Causes of over voltages and its effects on power system – Lightning phenomenon, switching surges and system faults –control of over voltages due to switching - protection of transmission line against over voltages	9
II	**ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS** Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Testing of insulating oils – Breakdown mechanisms in solid and composite dielectrics	9
III	**GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** Generation of High voltages / currents - DC, AC, impulse voltages and currents. Tripping and control of impulse generators	9
IV	**MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** Measurement of High DC, AC, impulse voltages and currents – cathode ray oscillographs for Impulse voltages and current measurements.	9
V	**HIGH VOLTAGE TESTING & INSULATION COORDINATION** High voltage testing of electrical power apparatus - Power frequency, impulse voltage and DC testing of Insulators, bushing, circuit breakers, isolators, cables and transformers– Insulation Coordination	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Categorize the various types of over voltages in power system and protection methods.
CO2: Analyze the various breakdown mechanisms in different dielectrics.
CO3: Classify the various generating techniques of high AC, DC and Impulse voltage.
CO4: Construct the circuits for high voltage and high current measurement.
CO5: Describe the high voltage testing of power apparatus and insulation coordination

TEXT BOOKS:

T1 - M. S. Naidu and V. Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 6th Edition, 2020.
T2 - E. Kuffel and W. S. Zaengel, "High Voltage Engineering Fundamentals", Pergamon Press, Oxford, London, 2000.

REFERENCE BOOKS:

R1 - C.L.Wadhwa, "High Voltage Engineering", New Age International Publishers,Third Edition,2012
R2 - Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi,Second Edition, 2013.
R3 - E. Kuffel and M. Abdullah, "High Voltage Engineering", Pergamon Press, Oxford, 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		3										2	
CO2	1	3	2		2								2	
CO3	2	1	3		2								3	
CO4	2	3	1		1								2	
CO5	2	2	2		2									
Avg	2	2.25	2.2		1.75								2.25	

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7302	Electrical Energy Utilization and Conservation	3	0	0	3

The student should be able to

Course Objective

1. To learn about different type of electric drives and the systems employed in electric traction.
2. To know about various lamps and design of illuminators schemes.
3. To familiarize with the existing methods, used for heating and welding.
4. To introduce the concepts of refrigeration and Air conditioning
5. To analyze the various energy saving methods

Unit	Description	Instructional Hours
I	**ELECTRIC DRIVES AND TRACTION** Fundamentals of Electric drive – choice of an Electric Motor – Application of motors for particular services. Traction Motors – Characteristic features of Traction motor – Systems of railway electrification – Electric Braking – Train movement and energy consumption – Traction Motor control – Track equipment and collection gear	9
II	**ILLUMINATION** Introduction – Definition and meaning of terms used in illumination Engineering – Classification of light sources. Incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps– Design of illumination systems – factory lighting halls – flood lighting – street lighting	9
III	**HEATING AND WELDING** Introduction – advantages of Electric heating – Modes of heat transfer – Methods of electric heating – Resistance heating –Direct –Indirect , Arc furnaces – Direct –Indirect , Induction heating – Direct – Indirect, Dielectric heating. Electric welding – Types – Resistance welding –Butt-Spot-Projection-Seam, Arc welding – Metal arc-Carbon arc, Requirements of good weld –Power supply for arc welding.	9
IV	**REFRIGERATION AND AIR CONDITIONING** Introduction – Refrigeration cycle – Refrigeration system – Types of refrigerants – Domestic refrigerator – Water coolers – Air conditioning systems– Classification of air conditioning systems – Central system — Heating of building.	9
V	**ECONOMICS OF ELECTRICAL ENERGY UTILIZATION** Economics of Electric power supply – General rule for charging the energy – power factor improvement – methods of reducing power factor occurrence – Economic choice of equipment – energy management – energy auditing – power quality	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Ability to choose suitable electric drives for different applications
CO2: Ability to design the illumination systems for energy saving
CO3: Ability to understand the utilization of electrical energy for heating and welding purposes
CO4: Illustrate the concepts of refrigeration and air conditioning
CO5: Apply the various method of energy saving and choosing suitable energy efficient systems

TEXT BOOKS:

T1 - Dr.N.V.Suryanarayana, Utilisation of Electric power, Wiley Eastern Limited, New Age International Limited, 2013.
T2 - J.B. Gupta, 'Utilization of Electric Power and Electric Traction', S.K. Kataria and Sons, 2002..

REFERENCE BOOKS:

R1 - R.K.Rajput, Utilisation of Electrical Power, Laxmi publications (P) Ltd., 2007
R2 - H.Partab, Art and Science of Utilisation of Electrical Energy, Dhanpat Rai and Co., New Delhi – 2004.
R3 - E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt. Ltd, 2003.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1	1		1	1			2	2	3	3
CO2	3	2	3	1	2			1			2	3	3	3
CO3	3	2	3	1	2					1	2	3	3	3
CO4	3	2	3	1	1	2	1		1		2	3	3	3
CO5	3	2	3	1	1	2	1	2	1		2	3	3	3
Avg	3	2	3	1	1.4	2	1	1.333	1	1	2	2.8	3	3

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7303	Internet of Things	3	0	0	3

Course Objective

The student should be able to

1. Understanding Elements of an internet of thing system.
2. Various wired network schemes for internet of things.
3. Improve the networking fundamentals.
4. Understanding the basic smart grid technologies
5. Analysing smart transmission systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO IoT** Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology	9
II	**IoTARCHITECTURE** M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture	9
III	**IoT PROTOCOLS** Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security	9
IV	**BUILDING IoT WITH RASPBERRY PI & ARDUINO** Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms – Arduino	9
V	**CASE STUDIES AND REAL-WORLD APPLICATIONS** Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs – Cloud for IoT –Amazon Web Services for IoT	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Differentiate the the various microcontrollers used for internet of things.
CO2: Various wired networking systems.
CO3: Evaluate the various networking system
CO4: Analyze the components of smart grids.
CO5: Analyze and design smart transmission technologies.

TEXT BOOKS:

T1 - Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approachl, Universities Press, 2015
T2 - Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsl, Springer, 2011

REFERENCE BOOKS:

R1 - Charles Bell, Beginning Sensor Networks with Arduino and Raspberry Pi , Apress, 2013
R2 - Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspectivel, CRC Press, 2012.
R3 - Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocolsl, Wiley,2012

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1		3												
CO2		3												
CO3		3			1									
CO4			3		2								2	
CO5			3		2								2	
Avg		3	3		1.6								2	

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7304	Nano Technology	3	0	0	3

The student should be able to

Course Objective

1. To introduce the concept and knowledge of Nano science and Nanotechnology.
2. To create awareness of clean room environment & societal implications of Nanotechnology
3. To know about preparation methods and nanofabrication techniques.
4. To know about the different characterization techniques used for Nano systems.
5. To understand the significant applications of nanotechnology

Unit	Description	Instructional Hours
I	**INTRODUCTION** Overview of Nano scale Science and Technology- Implications on Science, Engineering and society Nano structured materials- Properties- Nano toxicology-Clean room standards.	9
II	**PREPARARTION ROUTES** Preparation of nanoscale materials: precipitation, mechanical milling, colloidal routes, self-assembly; vapour phase deposition, CVDs, sputtering, evaporation, molecular beam epitaxy, atomic layer epitaxy.	9
III	**LITHOGRAPHY FOR NANO SCALE DEVICES** Lithography process, optical/UV, electron beam, Ion Beam and x-ray lithography, Nano imprint technique- Scanning probe lithography.	9
IV	**CHARECTERIZATION TECHNIQUES** X-ray and Neutron diffraction technique, Scanning Electron Microscopy plus environmental techniques, Transmission Electron Microscopy including high-resolution imaging, analytical electron microscopy, EDX and EELS, Surface Analysis techniques, XPS, SIMS, Auger.	9
V	**EVOLVING INTERFACES OF NANO** Applications of nanotechnology: NEMS – Nano sensor – Nano medicines –Nano applications in electrical engineering –Nano electronics: quantum transport devices, molecular electronics devices, quantum computing ,memory, CNT and its applications, Nano motor, Nano robot, energy efficient battery technology, Nano dielectrics, lighting system, solar cell.	9
	Total Instructional Hours	**45**

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

Course Outcome

CO1: Students will be able to understand the significance and implication of nanotechnology
CO2: To be able to apply the concept of nanotechnology for Electrical and Electronics EngineeringApplications
CO3: Familiar with Rules and guidelines of clean room standards
CO4: Understanding the Fabrication methods and characterization techniques
CO5: Students will be able to know the recent trends of nanotechnology

TEXT BOOKS:

T1 - Chattopadhyay K.K and A.N Banerjee, Introduction to Nanoscience and nanotechnology, PHI, 2009
T2 - . Pradeep, Nano the essentials, Tata-McGraw Hill Education, 2007

REFERENCE BOOKS:

R1 - B S Murthy,P Shankar, Baldev Raj, BB Rath& James Murday.'Text book of Nanoscience and Nano Technology',,Universities Press, 2011
R2 - Honbo Charles P.Poole & Frank ,J.Owens,Introduction to nanotechnology ,Wiley India,2007.
R3 - Jan Korwink and Andreas Greiner, Semiconductors for Micro and Nanotechnology: An Introduction forEngineers, Weinheim Cambridge: wiley-VCH,2001.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2		2										
CO2		3	2	2	2								2	
CO3		3	2	2									2	
CO4		3		2									2	
CO5		3		2									3	
Avg	3	2.8	2	2	2								2.25	

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7305	Wireless Sensor Network	3	0	0	3

Course Objective

The student should be able to

1. Introduce about Wireless sensor network
2. Various protocols for Wireless sensor network
3. Gain knowledge about routing and network layer
4. To learn about Time synchronization
5. Impart knowledge on network security

Unit	Description	Instructional Hours
I	**INTRODUCTION** Components of a wireless sensor node, Motivation for a Network of Wireless Sensor Nodes, Classification of sensor networks, Characteristics of wireless sensor networks, Challenges of wireless sensor networks, Comparison between wireless sensor networks and wireless mesh networks, Limitations in wireless sensor networks, Design challenges, Hardware architecture, Applications : Structural Health Monitoring, Traffic Control, Health Care, Architecture: The Sensing Subsystem, the Processor Subsystem, Communication Interfaces, Prototypes	9
II	**BASIC ARCHITECTURAL FRAMEWORK** Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation Medium Access Control: Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, and Hybrid MAC Protocols	9
III	**NETWORK LAYER** Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols Node and Network Management: Power Management, Local Power Management aspects, Dynamic Power Management, Conceptual Architecture	9
IV	**TIME SYNCHRONIZATION** Clocks and the Synchronization Problem, Time Synchronization in Wireless Sensor Networks, Basics of Time Synchronization, Time Synchronization Protocols Localization: Ranging Techniques, Range-Based Localization, Range-Free Localization, Event Driven Localization	9
V	**Network Security** Fundamentals of Network Security, Challenges of Security in Wireless Sensor Networks , Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and Zig Bee Security	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Understand the basics of wireless sensor network
CO2: Summarize the different protocol networks.
CO3: Describe the routing matrices and management aspects for network layer
CO4: Observe the time synchronizations in wireless sensor network
CO5: Study on fundamentals of security network.

TEXT BOOKS:

T1 - Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice",Wiley 2010
T2 - . Mohammad S. Obaidat, Sudip Misra, "Principles of Wireless Sensor Networks", Cambridge, 2014.

REFERENCE BOOKS:

R1 - Ian F. Akyildiz, Mehmet Can Vuran , "Wireless Sensor Networks", Wiley 2010
R2 - FEI HU., XIAOJUN CAO, "Wireless Sensor Networks", CRC Press, 2013
R3 - C S Raghavendra, K M Sivalingam, Taieb Znati, "Wireless Sensor Networks", Springer, 2010

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3		3			2						3	
CO2	3			3			2	2					3	3
CO3	3	2			3								3	3
CO4	2				3		3	3						3
CO5	2				3									3
Avg	2.6	2.5		3	3		2.33	2.5					3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / VII	21EE7401	Electric Vehicles	3	0	0	3

Course Objective

The student should be able to

1. Understand the different types of Electric Vehicle
2. Confer the basic principles of suitable power drive
3. Discuss the basic principles and determine the performance of suitable drive scheme for EV
4. Recognize the different energy storage systems for vehicle applications
5. Recognize the various characteristics of Braking Energy

Unit	Description	Instructional Hours
I	**OVERVIEW OF ELECRIC VEHICLES** Introduction Air Pollution – Global Warming - History of EVs - History of HEVs - Configurations of EVs - Performance of EVs - Tractive Effort in Normal Driving - Concept of Hybrid Electric Drive Trains .	9
II	**HYBRID ELECTRIC DRIVE TRAIN** Architectures of Hybrid Electric Drive Trains-Series Hybrid Electric Drive Trains – Parallel Hybrid Electric Drive Trains – Torque Coupling - Speed Coupling -Torque &Speed Coupling of Parallel Hybrid Electric Drive Trains.	9
III	**DC & AC ELECTRICAL MACHINES** DC Motor Drives - Principle of Operation - Multi-Quadrant Control - Chopper Fed DC Motor Drives - Induction Motor Drives - Constant Volt/Hertz Control - Permanent Magnetic BLDC Motor Drives - Performance Analysis and Control of BLDC Machines- SRM Drives and PMSM Drives	9
IV	**ENERGY STORAGE SOURCES : BATTERIES AND FUEL CELLS** Battery Basics – Types – Lead-Acid, Li-Ion, Li-Polymer, Ni-Cd, NiMH , Fuel cells – Types : AFC,PAFC,DMFC– Battery -SOC-SOH –Ultra capacitor	9
V	**FUNDAMENTALS OF REGENERATIVE BRAKING** Energy Consumption in Braking, - Braking Energy on Front and Rear Axles - Brake System of EV, HEV- Series Brake optimal feel-Optimal Energy recovery-Parallel brake, Antilock Brake System	9
	Total Instructional Hours	**45**

Course Outcome

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

CO1: Identify the Importance of EVs and HEVs
CO2: State a suitable drive scheme for developing an electric hybrid vehicle depending on resources
CO3: Design and develop basic drive schemes of electric vehicles and hybrid electric vehicles
CO4:Choose proper energy storage systems for vehicle applications
CO5: Identify various characteristics of Braking Energy.

TEXT BOOKS:

T1 - Mehrdad Ehsani, Yimini Gao & Ali emadi "Modern Electric, Hybrid Electric and Fuel cell Vehicles" Third Edition, CRC Press, 2018.

T2 - . Iqbal Husain, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press - Boca Raton London New York Washington, D.C. 2012

REFERENCE BOOKS:

R1 - Gianfranco Pistoia, "Electric and Hybrid Vehicles – Power sources, Models, Sustainability, Infrastructure and the market" Elsevier, The Netherlands – 2010

R2 - Ali emadi , "Handbook of Automotive Power Electronics and Motor Drives", Taylor & Francis, 2012

R3 - Ron Hodkinson and John Fenton, "Lightweight Electric/ Hybrid Vehicle Design", Butterworth-Heinemann, 2011

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3		3										2	
CO2	1	3	2										2	
CO3	2	1	3										3	
CO4	2	3	1										2	
CO5	2	2	2											
Avg	2	2.25	2.2										2.25	

Chairman, Board of Studies

Chairman - BOS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

2019 Regulation – 2021 Batch VII semester- Syllabus revision

S. No	Year	Semester	Course Code and Course Name	Existing content (in academic Year 2023-24)	Revised Content (for 2024-25)	Percentage of Revision
NIL						

New Course Introduced (2019 Regulation) – 2021 Batch VII semester

S.No	Regulation	Course Code with Name	Credits
NIL			

Chairman-BoS
Chairman - BoS
EEE - HiCET

Dean Academics
Dean (Academics)
HiCET

Chairman

Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

MINOR SYLLABUS

Programme	Course Code	Name of the course	L	T	P	C
BE	22EE5601	Introduction to Energy Studies	3	0	0	3

Course Objectives		The student should be able to
	1	Discuss various energy (Non-renewable &renewable) resources available in the country, their potential, exploitation/achievements etc..
	2	Examine application of daily load curve, power plant economics
	3	Analyze the concept of decentralized power generation system.
	4	Discuss Bio-energy resource assessment, physical and chemical properties, composition
	5	Illustrate the concept about the various types of energy technology and role of different agencies

Unit	Description	Instructional Hours
I	**ENERGY SCIENCE & TECHNOLOGY** Basics of Energy and its various forms- Advantages and Limitations - Mechanical Energy - Chemical Energy - Nuclear Energy - Hydro Energy - Renewable Energy Sources - Energy sources potential in India. Comparison of Fuels - Electricity on calorific value -Efficiencies of various Energy production and installed capacity in India.	9
II	**ENERGY ACTION PLANNING: AND LOAD DURATION CURVE** Energy Scenario in India- Base load and peak load power plants: Definition, classification only-Load factor – Capacity factor – Reserve factor – Demand Factor – Diversity factor –Plant use factor – Load duration curve -Selection of site - Energy Action Planning	9
III	**DECENTRALIZED POWER GENERATION** Concept – Cogeneration – Combined Heat and Power-.definition – need - advantages classification – working, applications- Tri-generation-construction, working. Waste heat recovery - Classification- advantages and applications - commercially viable waste heat recovery devices.	9
IV	**BIO FUELS** Bio fuels - Biomass-Bio diesel – Technology for production of bio diesel - Transesterification – Process – Usage of Methanol – Glycerine – Storage and Characterisation of biodiesel –Biodiesel using Jatropha-Biodiesel engine development – Environmental effects of biofuels –Biodiesel in India. Case study: Kitchen waste to biogas and power generation	9
V	**NODAL AGENCIES FOR ENERGY STUDIES** Ministry of Power in India – Role – MNRE-Ministry of New and Renewable Energy Sources – Role – CEA-Central Energy Authority-Role-Other implementing agencies – PCRA- Bureau of Energy Efficiency-Role- Energy Conservation Act – Energy conservation Schemes – Policies .. TEDA-Tamil Nadu Energy Development Agency: Role and schemes.	9
	Total Instructional Hours	**45**

At the end of course, students can able to

Course Outcomes

- CO1 Understand the various forms and its technology
- CO2 Examine energy action planning and power plant economics
- CO3 Analyze the concept of decentralized power generation system.
- CO4 Discuss Bio-energy resources and conversion technology
- CO5 Understand the concept and role of different energy agencies

TEXT BOOKS:

T1 Dr.L Ashok Kumar, Energy Audit and Management Concept, Methodologies, Procedures, and Case Studies CRC press,2022

T2 Bahman Zohuri, Patrick McDaniel, Introduction to Energy Essentials Insight into Nuclear, Renewable, and Non-Renewable Energies, Elsevier 1st Edition - March 15, 2021

T3 Bureau of energy efficiency (bee) (a statutory body under ministry of power, government of india Book-1: General Aspects of Energy Management and Energy Audit

REFERENCE BOOKS:

R1 BUREAU OF ENERGY EFFICIENCY (BEE) (A Statutory body under Ministry of Power, Government of IndiaBOOK-2: ENERGY EFFICIENCY IN THERMAL UTILITIES

R2 Mehmet Kanoğlu, Yunus A. Çengel Energy Efficiency and Management for Engineers, 1st Edition McGraw-Hill Education,2020

R3 Ognjen S. Miljanic, Joseph A. Pratt, Introduction to Energy and Sustainability,Willey, 2021

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-		-	3	-	-	3	3	3
CO2	3	3	3	-	3	-		-	3	-	-	3	3	3
CO3	3	3	3	2	3	-		-	3	-	-	3	3	3
CO4	3	3	3	2	3	-		-	3	-	-	3	3	3
CO5	3	3	3	2	3	-		-	3	-	-	3	3	3
Avg	3	3	3	2.1	2.5	-		-	3	-	-	3	3	2

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

HONOUR'S SYLLABUS

Programme	Course Code	Name of the course	L	T	P	C
BE	22EE5206	ENERGY MANAGEMENT AND AUDITING	3	0	0	3

Course Objectives

The student should be able

1. To study the concept of energy management and its opportunities
2. To study the Energy Conservation Act.2001 and Related Policies
3. To know energy auditing procedure
4. To understand the energy action planning
5. To understand the different methods used for the economic analysis of energy projects

Unit	Description	Instructional Hours
I	**Introduction** Energy consumption in India - sector wise- General principles of Energy management and Energy management planning. Peak Demand controls, Methodologies. Types of Industrial Loads, Optimal Load Scheduling-Introduction to Energy Studies: Energy Units and energy conversion-Integrated Energy Policy-Energy intensity on purchasing power parity (PPP)	9
II	**Energy Conservation Act.2001 and Related Policies** Energy Conservation and its importance-Salient features of the energy conservation Act,2001 and the energy conservation(amendment) Act,2010-role of State Designated Agencies-Duties-responsibilities-Schemes of BEE under the energy conservation Act-2001—Standards and Labeling (S&L), equipment's covered under S&L program-BLY-Bachat Lamp Yojana	9
III	**Energy Management and Audit** Definition and objectives of energy Management- Energy audit -Definition, Need, Types of energy audit approach- Preliminary energy audit-Targeted energy audit-Detailed energy audit- Preparing process flow diagram-Penicillin-G -ENCON-classification-Benchmarking-parameters for various sectors.	9
IV	**Energy Action planning :** Energy Action Planning-Top management support-Appointment of Energy Manager-Responsibilities and duties of energy manager-Energy policy and planning-Tools for effective implementation-5S, Kaizen and ISO 50001:2011-Energy Management System (EnMS) - Instruments and Metering for energy audit.	9
V	**Economic Analysis** Financial Analysis Techniques-Payback period-ROI-Return on Investment-Time value of Money – NPV method-Internal Rate of Return Method-ESCOs-Energy Service Companies-Roles of ESCOs-A Case study-Energy Efficiency in Buildings through ESCO	9
	Total Instructional Hours	**45**

Course Outcomes

- CO1 Understand the concept of energy management and its opportunities
- CO2 Discuss the energy conservation Act and related policies
- CO3 Analyze the energy auditing procedure
- CO4 Understand the energy action planning
- CO5 Evaluate the different methods used for the economic analysis of energy projects

TEXT BOOKS:

T1 Albert Thumann, William J. Younger, Handbook of Energy Audits, CRC Press, 2003

T2 D. Yogi Goswami, Frank Kreith, Energy Management and Conservation Handbook, CRC Press, 2007

T3 Dr.L Ashok Kumar, Energy Audit and Management Concept, Methodologies, Procedures, and Case Studies CRC press,2022

REFERENCE BOOKS:

R1 BUREAU OF ENERGY EFFICIENCY (BEE) (A Statutory body under Ministry of Power, Government of IndiaBOOK-1: GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT

R2 Mehmet Kanoğlu, Yunus A. Çengel Energy Efficiency and Management for Engineers, 1st Edition McGraw-Hill Education,2020

R3 Energy Audit Handbook-SEAI-Sustainable Energy Authority of Ireland https://www.seai.ie/publications/SEAI-Energy-Audit-Handbook.pdf

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	3	-	3	-	-	3	3	3
CO2	3	3	3	-	3	-	3	-	3	-	-	3	3	3
CO3	3	3	3	2	3	-	3	-	3	-	-	3	3	3
CO4	3	3	3	2	3	-	3	-	3	-	-	3	3	3
CO5	3	3	3	2	3	-	3	-	3	-	-	3	3	3
Avg	3	3	3	2.1	2.5	-	3	-	3	-	-	3	3	2

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

HONOUR'S SYLLABUS

Programme	Course Code	Name of the Course	L	T	P	C
BE	21EE7206	ELECTRIC VEHICLE MACHINES AND DRIVES	3	0	0	3

Course Objective

1. To introduce electric vehicles (EVs) and hybrid electric vehicles (HEVs), covering their configurations.
2. To provide with a comprehensive understanding of charging standards and infrastructures for electric vehicles.
3. To provide with an inclusive understanding of DC and AC motor propulsion drives.
4. To familiarize with permanent magnet (PM) motor propulsion drives.
5. To provide with a comprehensive understanding of switched reluctance motor (SRM) propulsion drives.

Unit	Description	Instructional Hours
I	**INTRODUCTION** EVs – Configuration and Performance of Electric Vehicle – Tractive Effort. Hybrid EVs – Concept of Hybrid Electric Drive trains – Architecture of Hybrid Electric Drive train.	9
II	**CHARGING AND BATTERIES** Charging standards and infrastructures – Wireless power transfer – Solar charging – Batteries: Overview and Types of Batteries – Fuel cell – Super capacitors – Flywheel.	9
III	**DC & AC MOTOR PROPULSION DRIVES** DC Motor Drives - Multi quadrant Control of Chopper fed DC Motor drives: Four Quadrant operation - Induction Motor Drives – Constant v/f Control – Power Electronic Control.	9
IV	**PM MOTOR PROPULSION DRIVES** Permanent Magnet Brushless DC Motor Drives – Sensorless technique – Permanent Magnet Synchronous motor drive – Converters.	9
V	**SRM PROPULSION DRIVES** Switched Reluctance Motor Drives - Sensorless control technique: Phase-Inductance base method – Modulated signal injection method.	9
	Total Instructional Hours	**45**

Course Outcome

1. Students will possess a solid understanding of electric vehicles and hybrid electric vehicles.
2. Students will be able to critically analyze and compare different charging standards and infrastructures for EVs.
3. Students will be proficient in analyzing, designing, and implementing DC and AC motor propulsion drives.
4. Students will have a deep understanding of PM motor propulsion drives.
5. Students will be proficient in analyzing, designing, and implementing SRM propulsion drives

TEXT BOOKS:

T1 Ali Emadi, Mehrdad Ehsani, John M.Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel Dekker,Inc2010

T2 Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor &Francis Group, Second Edition (2011).

REFERENCE BOOKS:

R1 Ehsani .,at., all.., Modern Electric Hybrid Electric And Fuel Vehicles, 3rd Edition, CRC Press, January 2019

R2 Ahmadian, Ali, Mohammadi-Ivatloo, Behnam, Elkamel, Al "Electric Vehicles in Energy Systems",Springer groupSecond Edition (2011

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				2					2	3	3
CO2	3	3	3				1	2				3	3	3
CO3	3	3	2		2		2	2				3	3	3
CO4	3	3	3		2		2	2				3	3	3
CO5	3	3	3		2		2	2				3	3	3
Avg	3.0	3.0	2.6		2.0		1.8	2.0				2.8	3.0	3.0

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE	21EE7205	ENERGY CONVERSION TECHNIQUES	3	0	0	3

Course Objective

1. To develop a comprehensive understanding of the thermodynamic principles underlying Conventional energy conversion cycles.
2. To provides with an in-depth understanding of the principles, mechanisms, and technologies involved in the direct conversion
3. To develop a comprehensive understanding of the principles and mechanisms involved in the conversion of chemical and electromagnetic energy
4. To provide with a comprehensive understanding of energy storage systems.
5. To provide students with a comprehensive understanding of fuel cells.

Unit	Description	Instructional Hours
I	**CONVENTIONAL ENERGY CONVERSION CYCLES** Reversible and irreversible cycles – Thermodynamics analysis of Carnot – Stirling – Ericsson – Otto – Diesel – Dual – Lenoir – Atkinson – Brayton - Rankine.	9
II	**DIRECT CONVERSION OF THERMAL TO ELECTRICAL ENERGY** Thermoelectric Converters –Thermionic converters – MHD – Ferro electric converter – Nernst effect generator.	9
III	**CHEMICAL & ELECTROMAGNETIC ENERGY TO ELECTRICAL ENERGY** Batteries – types – working – performance governing parameters – Hydrogen energy – Solar photovoltaic cells.	9
IV	**ENERGY STORAGE SYSTEMS** Energy Storage Technologies - Mechanical energy, Electrical energy, Chemical energy, Thermal energy.	9
V	**FUEL CELLS** Basics – types – working - comparative analysis – thermodynamics and kinetics of fuel cell process – performance of fuel cell – applications - advantages and drawbacks.	9
	Total Instructional Hours	**45**

Course Outcome

1. Students will be able to critically assess and apply the concepts of various energy conversion cycles
2. Students will be capable of evaluating and designing systems for the direct conversion of thermal to electrical energy, utilizing knowledge of various technologies.
3. Students will be able to analyze, evaluate, and design systems for the conversion of chemical and electromagnetic energy into electrical energy.
4. Students will be equipped with the knowledge and skills to analyze, evaluate, and design energy storage systems.
5. students will be able to analyze and compare different types of fuel cells

TEXT BOOKS:

T1 Barclay F.J., "Fuel Cells, Engines and Hydrogen", Wiley, 2009
T2 ArchieW.Culp, "Principles of Energy Conversion", McGraw-Hill Inc., Singapore, 1991.
T3 Hart A.B. and Womack G.J., "Fuel Cells: Theory and Application", Prentice Hall Newyork Ltd., London 1989.

REFERENCE BOOKS:

R1 Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & Sons 2002.
R2 Kettari M.A., "Direct Energy Conversion", Addison-Wesley Pub. Co 1997.
R3 Kordesch K. and Simader G., "Fuel Cell and Their Applications", Wiley-Vch, Germany 1996.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	2				1					2	3	3
CO2	3	3	3		1		1					3	3	3
CO3	3	3	2				1					3	3	3
CO4	3	3	3		1		1					3	3	3
CO5	3	2	3		1		1					3	3	3
Avg	3.0	2.8	2.6		1.0		1.0					2.8	3.0	3.0

Chairman, Board of Studies

Chairman - BoS
EEE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

MINOR SYLLABUS

Programme	Course Code	Name of the course	L	T	P	C
BE	21EE7602	ENERGY STORAGE SYSTEMS	3	0	0	3

Course Objectives

1. To understand the various types of energy storage Technologies.
2. To analyze thermal storage system.
3. To analyze different battery storage technologies.
4. To analyze the thermodynamics of Fuel Cell
5. To study the various applications of energy storage systems.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Energy Storage System (ESS) Introduction-Necessity of energy storage – types of energy storage – comparison of energy storage technologies – Pumped hydro scheme - Hydrogen storage-Applications. Case Study: Simulate and analyze the performance characteristics of thermal storage systems	9
II	**THERMAL STORAGE SYSTEM** : Thermal storage – Types – Modeling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system – Simple units, packed bed storage units - Modelling using porous medium approach. Use of TRNSYS simulation program	9
III	**ELECTRICAL ENERGY STORAGE**: Fundamental concept of batteries – measuring of battery performance, charging and discharging, power density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Li-ion batteries - Mathematical Modelling for Lead Acid Batteries. Case study: Simulate and analyze the performance characteristics of Lead Acid Batteries	9
IV	**FUEL CELL:** Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantages and disadvantages. Case study: Simulate and analyze the performance characteristics of Fuel Cell	9
V	**ALTERNATE ENERGY STORAGE TECHNOLOGIES**: Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications. Case Study: Techno-economic analysis of different types of storage systems	9
	Total Instructional Hours	**45**

Course Outcomes

CO1 :Analyze the appropriate storage technologies for different applications
CO2 : Design a thermal storage system.
CO3 : Model battery storage system
CO4 : Analyze the thermodynamics of fuel cell
CO5 : Explore the alternate energy storage technologies.

TEXT BOOKS:

T 1 Ibrahim Dincer and Mark A. Rosen, 'Thermal Energy Storage Systems and Applications', John Wiley & Sons, 3rd Edition, 2021.
T 2 James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3rd Edition, 2018.

REFERENCE BOOKS:

R 1: B.H.Khan "Non-conventional Energy sources", Tata McGraw hill Publishing Company, New Delhi, 2017, 3rd Edition
R2: Lunardini.V.J, 'Heat Transfer in Cold Climates', John Wiley and Sons 1981, 1st Edition
R3: Schmidt.F.W. and Willmott.A.J., 'Thermal Energy Storage and Regeneration', Hemisphere Publishing Corporation, 1981, 1st Edition.

COs/POs/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3									3	3	3
CO 2	3		3									3	3	3
CO 3	3		3									3	3	3
CO 4	3		3									3	3	3
CO 5	3	2	3									3	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
BE	22EE7601	Wind Energy Conversion Systems	3	0	0	3

Course Objectives

1. To provide knowledge about different types of renewable energy systems.
2. To provide knowledge on wind speed and its characteristics
3. To analyze the various instruments for wind measurement
4. To understand knowledge about wind energy conversion system and its components
5. To analyze the various electrical Generators used for the Wind Energy Conversion Systems

Unit	Description	Instructional Hours
I	**INTRODUCTION TO RENEWABLE ENERGY SYSTEMS** Classification of Energy Sources – Importance of Non-conventional energy sources – Advantages and disadvantages of non-conventional energy sources - Impacts of renewable energy generation on the environment - Qualitative study of renewable energy resources: Wind Energy –installed capacity of wind power plant in global, India and Tamil Nadu.	9
II	**WIND ENERGY:** Power in the Wind – nature of wind Derivation of Betz's limit- Site selection for wind farms – characteristics - Upwind scheme- Down wind scheme- Tip Speed-Tip Speed Ratio -Types of Wind Power Plants (WPPs)– Components of WPPs-Working of WPPs.	9
III	**INSTRUMENTATION FOR WIND MEASUREMENTS:** Importance of wind measurement-Instruments for wind measurements-Classification-anemometer-types-cup and vane type-construction and working-comparison-Ultrasonic or laser-based devices-construction, working, applications.	9
IV	**Wind Energy Conversion Systems-**Wind Energy Conversion System-Operating principles and characteristics - Components of WECS. Types of wind turbine-Horizontal axis wind turbine- Vertical axis wind turbine –components, construction and working-Stall Control, Pitch Control and Yaw control. Environmental issues of wind energy conversion system	9
V	**ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS):** Types of wind generators- Construction, Principle of operation: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG). Comparison of wind generators-Grid integration issues	9
	Total Instructional Hours	**45**

Course Outcomes

CO1 – Analyze the impacts of renewable energy technologies on the environment
CO2 Infer the wind energy systems
CO3 Interpret the instrumentation for wind energy measurement
CO4 Analyze the WECS and its components
CO5 Select a suitable Electrical machine for Wind Energy Conversion Systems

TEXT BOOKS:

T 1 D. P. Kothari, S. Umashankar, Wind Energy Systems and Applications, Narosa publishers,2017
T 2 S.M. Muyeen, "Wind Energy Conversion Systems", Springer First Edition, 2012
T 3: Md. Rabiul Islam, Md. Rakibuzzaman Shah, Mohd Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", CRC Press, First Edison, 2021

REFERENCE BOOKS:

R 1. B.H.Khan "Non-conventional Energy sources", Tata McGraw hill Publishing Company, New Delhi, 2017, 3rd Edition
R2: Gray, L. Johnson, "Wind energy system", Prentice Hall of India, 2nd Edition, 2006
R3: D.P.Kothari, K.C.Singal, RakeshRanjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India, New Delhi, 2009

COs/POs/ PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3									3	3	3
CO 2	3	2	3									3	3	3
CO 3	3	2	3									3	3	3
CO 4	3	2	3									3	3	3
CO 5	3	2	3									3	3	3

Chairman, Board of Studies
Chairman - BoS
EEE - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ACADEMIC COUNCIL Chairman

Dean – Academics
Dean (Academics)
HiCET