SRI KRISHNA COLLEGE OF
ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University
Accredited by NAAC with A++ Grade, Kuniamuthur, Coimbatore - 641008

nirf 83rd Rank

DEPARTMENT OF
ELECTRICAL AND ELECTRONICS ENGINEERING
(Accredited by NBA)

AUTONOMOUS
CURRICULUM AND SYLLABI
VII - VIII (SEMESTERS)

REGULATIONS 2022

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade
Kuniamuthur, Coimbatore – 641008
Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2022

2022-2026 Batch

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

(Batch 2022-2026)

VISION OF THE INSTITUTION

- To Produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities.

MISSION OF THE INSTITUTION

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills.
- To instill ethical values, imbibe a sense of social responsibility, and strive for societal well-being.
- To identify the needs of society and offer sustainable solutions through outreach programs.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION OF THE DEPARTMENT

- To provide the students with high quality technical education in the field of Electrical and Electronics Engineering enabling them to become competent and responsible engineers with employability and entrepreneurial skills.

MISSION OF THE DEPARTMENT

- To equip the students with adequate knowledge in the field of Electrical and Electronics Engineering and professional skills necessary to face the future challenges with confidence and courage.
- To enrich them to engage in research activities leading to innovative applications of technology.
- To enable them to become responsible citizens of the country with a willingness to serve the society.

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Exhibit technical competence in Electronics and Communication Engineering by providing innovative engineering solutions and excel in professional career.
PEO 2	Indulge in problem identification, analysis and formulation to provide technically superior, economically feasible, environmentally compatible and socially acceptable design solutions.
PEO 3	Contribute towards entrepreneurship and research, and exercise leadership through effective communication, teamwork and knowledge upgradation through lifelong learning.

II. PROGRAMME OUTCOMES (POs)	
PO 1	**Engineering Knowledge:** Apply the knowledge of basic sciences and engineering fundamentals to solve engineering problems.
PO 2	**Problem Analysis:** Analyze the complex engineering problems and give solutions related to chemical & allied industries
PO 3	**Design/ Development of Solutions:** Identify the chemical engineering problems, design and formulate solutions to solve both industrial & social related problems.
PO 4	**Conduct Investigations of Complex Problems:** Design & conduct experiments, analyze and interpret the resulting data to solve Chemical Engineering problems.
PO 5	**Modern Tool Usage:** Apply appropriate techniques, resources and modern engineering & IT tools for the design, modelling, simulation and analysis studies.
PO 6	**The Engineer and Society:** Assess societal, health, safety, legal and cultural issues and their consequent responsibilities relevant to professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the relationship between society, environment and work towards sustainable development.
PO 8	**Ethics:** Understand their professional and ethical responsibility and enhance their commitment towards best engineering practices.
PO 9	**Individual and Team Work:** Function effectively as a member or a leader in diverse teams, and be competent to carry out multidisciplinary tasks.
PO 10	**Communication:** Communicate effectively in both verbal & non-verbal and able to comprehend & write effective reports.
PO 11	**Project Management and Finance:** Understand the engineering and management principles to manage the multidisciplinary projects in whatsoever position they are employed.
PO 12	**Life-Long Learning:** Recognize the need of self-education and life-long learning process in order to keep abreast with the ongoing developments in the field of engineering

III. PROGRAMME SPECIFIC OUTCOMES (PSOs)

The Graduates of B.E – ELECTRICAL AND ELECTRONICS ENGINEERING programme will be able to:

PSO 1	Analyze basic scientific concepts and provide solutions to Electrical and Electronics Engineering problems with a specific focus on emerging energy challenges.
PSO 2	Use relevant software, apply current techniques for data processing problems in the field of modern electronic systems for sustainable development.
PSO 3	Develop products/software to cater to the societal & Industrial needs and adapt ethical values so as to become successful electrical engineering professionals.

II. IV. MAPPING OF PEOs WITH POs

PEO	**Pos**										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
1	3	3	3	2	3	2	2	3	3	3	2
2	3	3	3	3	3	2	2	2	2	2	3
3	2	2	2	2	2	2	2	3	3	3	2
4	3	3	3	2	2	3	3	3	2	2	2
5	3	3	2	3	3	2	2	2	2	2	3
	1- low, 2 - medium, 3 - high, '-' - no correlation										

V. MAPPING OF PEOs WITH PSOs

	PSO 1	**PSO 2**	**PSO 3**
PEO 1	3	2	3
PEO 2	3	3	2
PEO 3	2	3	3
PEO 4	3	2	3
PEO 5	2	3	2
PEO 1	3	2	3

AUTONOMOUS CURRICULA AND SYLLABI

Regulations 2022

SEMESTER I							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22SB102	Biology for Engineers	3/0/0	3	3	60/40	BSC
2	22MA104	Calculus and Transforms I	3/1/0	4	4	60/40	BSC
Theory with Practical (Internal 50 Marks & External 50 Marks)							
3	22PH102	Physics for Electrical Science	3/0/2	5	4	50/50	BSC
4	22EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
5	22IT101	Application Development Practices	3/0/2	5	4	50/50	ESC
7	22CS101	Problem Solving using C++	3/0/2	5	4	50/50	ESC
Mandatory Course (Internal 100 Marks)							
8	22MC101	Mandatory Course I: Induction Programme	3 Weeks		0	0/100	MC
		TOTAL	**17/1/10**	**26**	**22**	**700**	

SEMESTER II							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
2	22EE201	Basics of Electrical Circuits	2/1/0	3	3	60/40	BSC
3	22TA101	Heritage of Tamils	1/0/0	1	1	60/40	HSMC
Theory with Practical (Internal 50 Marks & External 50 Marks)							
4	22CH101	Engineering Chemistry	3/0/2	5	4	50/50	BSC
5	22IT201	Database Management Systems	3/0/2	5	4	50/50	ESC
6	22AD201	Java Programming	3/0/2	5	4	50/50	ESC
7	22EE202	Analog Electronics	3/0/2	5	4	50/50	PCC

Practical (Internal 60 Marks & External 40 Marks)							
8	22EE203	Basics of Electrical Circuits Laboratory	0/0/2	2	1	40/60	BSC
Mandatory Course (Internal 100 Marks)							
9	22MC102	Mandatory Course II: Environmental Sciences	1/0/0	1	0	0/100	MC
		TOTAL	**19/1/10**	**30**	**24**	**900**	

SEMESTER III

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Ext/Int	Cat.
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE301	Electrical Machines-I	3/0/0	3	3	60/40	PCC
2	22EE302	Digital Electronics	3/0/0	3	3	60/40	PCC
3	22EE303	Linear Integrated Circuits	3/0/0	3	3	60/40	PCC
4	22MA304	Calculus and Transforms II	3/1/0	4	4	60/40	BSC
5	22TA201	Tamils and Technology	1/0/0	1	1	60/40	HSMC
Theory with Practical (Internal 50 Marks & External 50 Marks)							
6	22CS201	Data Structures and Algorithms	1/0/4	5	3	50/50	ESC
7	22CS301	Advanced Java Programming	1/0/4	5	3	50/50	ESC
Practical (Internal 60 Marks & External 40 Marks)							
8	22EE304	Electrical Machines-I Laboratory	0/0/2	2	1	40/60	PCC
9	22EE305	Linear and Digital Integrated Circuits Laboratory	0/0/2	2	1	40/60	PCC
		TOTAL	**15/1/12**	**28**	**22**	**900**	

SEMESTER IV

S.No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Ext/Int	Cat.
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE401	Electrical Machines-II	3/0/0	3	3	60/40	PCC
2	22EE402	Electric Power Generation	3/0/0	3	3	60/40	PCC
3	22EE403	Control Systems	3/1/0	4	4	60/40	PCC

4	22MA402	Probability and Computational Methods	3/1/0	4	4	60/40	BSC
5	22EE0XX	Open Elective-I	1/0/4 (or) 3/0/0	5 (or) 3	3	40/60 (or) 60/40	OEC
6	22EE0XX	Open Elective-II	0/0/6 (or) 3/0/0	6 (or) 3	3	40/60 (or) 60/40	OEC
Practical (Internal 60 Marks & External 40 Marks)							
7	22EE404	Electrical Machines-II Laboratory	0/0/2	2	1	40/60	PCC
8	22EE405	Control Systems Laboratory	0/0/2	2	1	40/60	PCC
Mandatory Course (Internal 100 Marks)							
9	22MC1XX	Mandatory Course III	1/0/0	1	0	0/100	MC
		TOTAL	**14/2/14 (or) 19/2/04**	**30 (or) 25**	**22**	**900**	

SEMESTER V							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE501	Transmission and Distribution	3/0/0	3	3	60/40	PCC
2	22EE502	Power Electronics	3/0/0	3	3	60/40	PCC
3	22EE503	Measuring Instruments and Smart Sensors	3/0/0	3	3	60/40	PCC
4	22EE0XX	Open Elective-III	0/0/6 (or) 3/0/0	6 (or) 3	3	40/60 (or) 60/40	OEC
5	22EE9XX	Professional Elective-I	3/0/0	3	3	60/40	PEC
Theory with Practical (Internal 50 Marks & External 50 Marks)							
6	22EE504	Virtual Instrumentation	3/0/2	5	4	50/50	PCC
Practical (Internal 60 Marks & External 40 Marks)							
7	22EE505	Power Electronics Laboratory	0/0/2	2	1	40/60	PCC

Mandatory Course (Internal 100 Marks)							
8	22MC1XX	Mandatory Course IV	1/0/0	1	0	0/100	MC
		TOTAL	**15/1/12 (or) 15/1/9**	**26 (or) 23**	**20**	**800**	

SEMESTER VI							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE601	Power System Analysis	3/0/0	3	3	60/40	PCC
2	22EE9XX	Professional Elective -II	3/0/0	3	3	60/40	PEC
3	22EE9XX	Professional Elective -III	3/0/0	3	3	60/40	PEC
4	22EE0XX	Emerging Elective - I	3/0/0	3	3	60/40	EEC
5	22EC611	Principles of Digital Signal Processing	3/0/0	3	3	60/40	PCC
Theory with Practical (Internal 50 Marks & External 50 Marks)							
6	22EE602	Microcontrollers	3/0/2	5	4	50/50	PCC
Practical (Internal 60 Marks & External 40 Marks)							
7	22EE603	Power System Simulation Laboratory	0/0/2	2	1	40/60	PCC
8	22EC612	Principles of Digital Signal Processing Laboratory	0/0/2	2	1	40/60	PCC
Mini Project (Internal 60 Marks & External 40 Marks)							
9	22EE604	Mini Project - I	0/0/2	2	1	40/60	PROJ
		TOTAL	**18/0/8**	**26**	**22**	**900**	

SEMESTER VII							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE701	Power System Protection and Switchgear	3/0/0	3	3	60/40	PCC
2	22MG702	Engineering Economics	3/0/0	3	3	60/40	HSMC
3	22EE9XX	Professional Elective-IV	3/0/0	3	3	60/40	PEC
4	22EE0XX	Professional Elective-V	3/0/0	3	3	60/40	PEC

5	22EE0XX	Professional Elective-VI	3/0/0	3	3	60/40	PEC
6	22EE9XX	Emerging Elective-II	3/0/0	3	3	60/40	EEC
Practical (Internal 60 Marks & External 40 Marks)							
7	22EE702	Project I	0/0/6	6	3	40/60	PROJ
Internship (Internal 100 Marks)							
8	22EES01	Employment Enhancement Skills (Internship)	28 days		2	0/100	INT
TOTAL			**18/0/6**	**24**	**23**	**800**	

SEMESTER VIII							
S.No	**Course Code**	**Course Title**	**L/T/P**	**Contact Hrs/Wk**	**Credits**	**Ext/Int**	**Cat.**
Theory (Internal 40 Marks & External 60 Marks)							
1	22EE801	Project - II	0/0/24	24	12	40/60	PROJ
TOTAL			**0/0/24**	**24**	**12**	**100**	

SCHEME OF CREDIT DISTRIBUTION – SUMMARY											
Sl. No.	**Stream**	**Credits/Semester**								**C**	**%**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**		
1	**Humanities & Social Sciences Including Management (HSMC)**	3	4	1	-	-	-	3	-	**11**	6.58
2	**Basic Sciences (BSC)**	11	8	4	4	-	-	-	-	**27**	16.17
3	**Engineering Sciences (ESC)**	8	8	6	-	-	-	-	-	**22**	13.17
4	**Professional Core (PCC)**	-	4	11	12	14	12	3	-	**56**	33.53
5	**Professional Electives (PEC)**	-	-	-	-	3	6	9	-	**18**	10.79
6	**Open/Emerging/Industry (OEC)**	-	-	-	6	3	3	3		**15**	8.98
7	**Project Work (PROJ)**	-	-	-	-	-	1	5	12	**18**	10.78
8.	**Mandatory Course (MC) / Spoken Hindi**	0	0	-	0	0	-	-	-	**0**	0
Total		**22**	**24**	**22**	**22**	**20**	**22**	**23**	**12**	**167**	**100**

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM			
S. No.	**Course Work - Subject Area**	**AICTE Suggested Credits**	**SKCET Credits (167)**
1.	Humanities and Social Sciences (HS), including Management;	12*	11
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	26*	27
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical/Electronics/Mechanical/Computer Engineering, Instrumentation;	20*	22
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required	53*	56
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch;	18*	18
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas;	18*	15
7.	Project Work, Seminar and/or Internship in Industry or elsewhere.	11*	18
8.	Mandatory Courses (MC)	Non-credit	Non-credit
Total		**160**	**167**
**Minor Variations is allowed as per need of the respective disciplines*			

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (11 Credits)							
S.No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
1.	22EN101	Technical Communication Skills	2/0/2	4	3	50/50	HSMC
2.	22GE201	Universal Human Values	3/0/0	3	3	60/40	HSMC
3.	22TA101	Heritage of Tamils	1/0/0	1	1	60/40	HSMC
4.	22TA201	Tamils and Technology	1/0/0	1	1	60/40	HSMC
5.	22MG702	Engineering Economics	3/0/0	3	3	60/40	HSMC

BASIC SCIENCE COURSES (27 Credits)							
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
1.	22MA104	Calculus and Transforms I	3/1/0	4	4	60/40	BSC

2.	22SB102	Biology for Engineers	3/0/0	3	3	60/40	BSC
3.	22PH916	Physics for Electrical Science	3/0/2	5	4	50/50	BSC
4.	22CH916	Engineering Chemistry	3/0/2	5	4	50/50	BSC
5.	22EE201	Basics of Electrical Circuits	2/1/0	3	3	60/40	BSC
6.	22MA304	Calculus and Transforms II	3/1/0	4	4	60/40	BSC
7.	22MA402	Probability and Computational Methods	3/1/0	4	4	60/40	BSC
8.	22EE203	Basics of Electrical Circuits Laboratory	0/0/2	2	1	40/60	BSC

ENGINEERING SCIENCE COURSES (22 Credits)

S.No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Ext/ Int	Cat.
1.	22IT101	Application Development Practices	3/0/2	5	4	50/50	ESC
2.	22CS101	Problem Solving using C++	3/0/2	5	4	50/50	ESC
3.	22IT201	Database Management Systems	3/0/2	5	4	50/50	ESC
4.	22AD201	Java Programming	3/0/2	5	4	50/50	ESC
5.	22CS201	Data Structures and Algorithms	1/0/4	5	3	50/50	ESC
6.	22CS301	Advanced Java Programming	1/0/4	5	3	50/50	ESC

PROFESSIONAL CORE COURSES (56 Credits)

S.No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Ext/ Int	Cat.
1.	22EE202	Analog Electronics	3/0/2	5	4	50/50	PCC
2.	22EE301	Electrical Machines-I	3/0/0	3	3	60/40	PCC
3.	22EE302	Digital Electronics	3/0/0	3	3	60/40	PCC
4.	22EE303	Linear Integrated Circuits	3/0/0	3	3	60/40	PCC
5.	22EE304	Electrical Machines- I Laboratory	0/0/2	2	1	40/60	PCC
6.	22EE305	Linear and Digital Integrated Circuits Laboratory	0/0/2	2	1	40/60	PCC
7.	22EE401	Electrical Machines-II	3/0/0	3	3	60/40	PCC

8.	22EE402	Electric Power Generation	3/0/0	3	3	60/40	PCC
9.	22EE403	Control System	3/1/0	4	4	60/40	PCC
10.	22EE404	Electrical Machines-II Laboratory	0/0/2	2	1	40/60	PCC
11.	22EE405	Control System Laboratory	0/0/2	2	1	40/60	PCC
12.	22EE501	Transmission and Distribution	3/0/0	3	3	60/40	PCC
13.	22EE502	Power Electronics	3/0/0	3	3	60/40	PCC
14.	22EE503	Measuring Instruments and Smart sensors	3/0/0	3	3	60/40	PCC
15.	22EE504	Virtual Instrumentation	3/0/2	5	4	50/50	PCC
16.	22EE505	Power Electronics Laboratory	0/0/2	2	1	40/60	PCC
17.	22EE601	Power System Analysis	3/0/0	3	3	60/40	PCC
18.	22EE602	Microcontrollers	3/0/2	5	4	50/50	PCC
19.	22EC611	Principles of Digital Signal Processing	3/0/0	3	3	60/40	PCC
20.	22EE603	Power System Simulation Laboratory	0/0/2	2	1	40/60	PCC
21.	22EC612	Principles of Digital Signal Processing Laboratory	0/0/2	2	1	40/60	PCC
22.	22EE701	Power System Protection and Switchgear	3/0/0	3	3	60/40	PCC

PROFESSIONAL ELECTIVE COURSES (18 Credits)							
S. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
ELECTIVE STREAM I – POWER ENGINEERING							
1.	22EE901	Power System Management and Monitoring	3/0/0	3	3	60/40	PEC
2.	22EE902	Power System Operation and Ecconomics	3/0/0	3	3	60/40	PEC
3.	22EE903	Power Quality	3/0/0	3	3	60/40	PEC
4.	22EE904	High Voltage Engineering	3/0/0	3	3	60/40	PEC
5.	22EE905	Power System Automation	3/0/0	3	3	60/40	PEC
6.	22EE906	Residential Electrical Systems	3/0/0	3	3	60/40	PEC

ELECTIVE STREAM II - APPLIED ELECTRONICS							
1.	22EE907	Process Control and Instrumentation	3/0/0	4	3	60/40	PEC
2.	22EE908	Avionics Technology	3/0/0	3	3	60/40	PEC
3.	22EE909	Nano Technology	3/0/0	3	3	60/40	PEC
4.	22EE910	VLSI Technology	3/0/0	3	3	60/40	PEC
5.	22EE911	FPGA Based System Design	3/0/0	3	3	60/40	PEC
6.	22MT907	Product Design	3/0/0	3	3	60/40	PEC
ELECTIVE STREAM III - INTEGRATED ELECTRONIC SYSTEMS							
1.	22EE912	Embedded System Design using ARM	3/0/0	3	3	60/40	PEC
2.	22EE913	Machine Learning for Embedded Applications	3/0/0	3	3	60/40	PEC
3.	22EE914	Embedded System Programming	3/0/0	3	3	60/40	PEC
4.	22EE915	Embedded Systems for Automotive Applications	3/0/0	3	3	60/40	PEC
5.	22EE916	Embedded Systems in Smart Grid	3/0/0	3	3	60/40	PEC
6.	22EE917	Embedded Control for Electrical Drives	3/0/0	3	3	60/40	PEC
ELECTIVE STREAM IV – CONVERTER AND DRIVES							
1.	22EE918	Design of Electrical Machines	3/0/0	3	3	60/40	PEC
2.	22EE919	Special Electrical Machines	3/0/0	3	3	60/40	PEC
3.	22EE920	PLC, SCADA and Automation	3/0/0	3	3	60/40	PEC
4.	22EE921	Servo Drives in Robotics	3/0/0	3	3	60/40	PEC
5.	22EE922	Modern Power Converters	3/0/0	3	3	60/40	PEC
6.	22EE923	Intelligent Controllers for Drone Technology	3/0/0	3	3	60/40	PEC

ELECTIVE STREAM V – RENEWABLE ENERGY SYSTEMS							
1.	22EE924	Optimal Energy Controllers	3/0/0	3	3	60/40	PEC
2.	22EE925	Industrial Electrification using Renewable Energy System	3/0/0	3	3	60/40	PEC
3.	22EE926	Power Electronics for Renewable Energy System	3/0/0	3	3	60/40	PEC
4.	22EE927	Hybrid Smart grid Technology	3/0/0	3	3	60/40	PEC
5.	22EE928	Fuel Cell and Biogas System	3/0/0	3	3	60/40	PEC
6.	22EE929	Renewable Energy and Storage Systems	3/0/0	3	3	60/40	PEC
7.	22EE930	Hybrid Wind and Solar Electric System	3/0/0	3	3	60/40	PEC

ELECTIVE STREAM VI – E- MOBILITY							
1.	22EE931	Electric Vehicle Technology	3/0/0	3	3	60/40	PEC
2.	22EE932	Vehicle Design and Fabrication	3/0/0	3	3	60/40	PEC
3.	22EE933	Autonomous Electric Vehicle	3/0/0	3	3	60/40	PEC
4.	22EE934	Vehicle-to-Grid Integration	3/0/0	3	3	60/40	PEC
5.	22EE935	Renewable Energy Integration with EV Charging	3/0/0	3	3	60/40	PEC
6.	22EE936	Plug-in Hybrid Electric Vehicles (PHEV)	3/0/0	3	3	60/40	PEC
7.	22EE937	Electric Power Train	3/0/0	3	3	60/40	PEC

OPEN/ EMERGING/ INDUSTRY (15 Credits)							
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
1.	22EE001	Residential and Commercial Electrical Systems	3/0/0	3	3	60/40	OEC
2.	22EE002	Autonomous Vehicles	3/0/0	3	3	60/40	OEC
3.	22EE003	Special Purpose Machines	3/0/0	3	3	60/40	OEC
4.	22EE004	Renewable Energy Sources	3/0/0	3	3	60/40	OEC
5.	22EE005	Servo and Robot Drives	3/0/0	3	3	60/40	OEC
6.	22EE006	Industrial Safety Management	3/0/0	3	3	60/40	OEC
7	22EE007	Machine Learning Applications in Energy Systems	3/0/0	3	3	60/40	EEC
8	22EE008	Big Data Analytics for Smart Grid	3/0/0	3	3	60/40	EEC
9	22EE009	High Voltage Insulation Technology	3/0/0	3	3	60/40	EEC
10	22EE010	Internet of Things for Electrical Systems	3/0/0	3	3	60/40	EEC
11	22EE011	Rapid System Prototyping with FPGAs	3/0/0	3	3	60/40	EEC
12	22EE012	Electric Vehicle Cyber Security	3/0/0	3	3	60/40	EEC

PROJECT WORK (16 Credits)							
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
1.	22EE702	Project - I	0/0/6	6	3	40/60	PROJ
2.	22EE604	Mini Project- I	0/0/2	2	1	40/60	PROJ
3.	22EE801	Project - II	0/0/24	24	12	40/60	PROJ

PROFESSIONAL ELECTIVE COURSES: VERTICALS					
Vertical I	**Vertical II**	**Vertical III**	**Vertical IV**	**Vertical V**	**Vertical VI**
Power System Management and Monitoring	Process Control and Instrumentation	Embedded System Design using ARM	Design of Electrical Machines	Optimal Energy Controllers	Electric Vehicle Technology
Power System Operation and Ecconomics	Avionics Technology	Machine Learning for Embedded Applications	Special Electrical Machines	Industrial Electrification using Renewable Energy System	Vehicle Design and Fabrication
Power Quality	Nano Technology	Embedded System Programming	PLC, SCADA and Automation	Power Electronics for Renewable Energy System	Autonomous Electric Vehicles
High Voltage Engineering	VLSI Technology	Embedded Systems for Automotive Applications	Servo Drives in Robotics	Hybrid Smart grid Technology	Vehicle-to-Grid Integration
Power System Automation	FPGA Based System Design	Embedded Systems in Smart Grid	Modern Power Converters	Fuel Cell and Biogas System	Renewable Energy Integration with EV Charging
Residential Electrical Systems	Product Design	Embedded Control for Electrical Drives	Intelligent Controllers for Drone Technology	Renewable Energy and Storage Systems	Plug-in Hybrid Electric Vehicles (PHEV)
				Hybrid Wind and Solar Electric System	Electric Power Train

INTERN (2 Credits)							
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	Ext/ Int	Cat.
1.	22EES01	Employment Enhancement Skills (Internship)	28 days		2	0/100	INT

VALUE ADDED COURSES (Based on student's interest)			
S. No	Course Code	Course Title	Sem
1.	22VA301	Solar Energy Technology	III/IV
2.	22VA302	Industry 4.0 using Industrial Internet of Things	V/VI
3.	22VA303	Microgrid Technology	V/VI
4.	22VA304	FPGA-based Switched Mode Power Converters	V/VI
5.	22VA305	Phase-Locked Loop Circuit Design	V/VI
6.	22VA306	Substation Designing	V/VI
7.	22VA307	Contemporary Digital Techniques	V/VI
8.	22VA308	Recent Power Electronics and Control	V/VI
9.	22VA309	Neuro-Instrumentation	III/IV
10.	22VA310	Massive Open Online Cources (MOOC)/ NPTEL	I-VIII

MANDATORY COURSES (Non-Credits) (Courses conducted either by internal faculty or through MOOCs)							
SL. No	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**Ext/ Int**	**Cat.**
1.	22MC101	Induction Program	3 weeks		0	0/100	MC
2.	22MC102	Environmental Sciences	1/0/0	1	0	0/100	MC
3.	22MC103	Soft Skills	1/0/0	1	0	0/100	MC
4.	22MC104	Management Organizational Behavior	1/0/0	1	0	0/100	MC
5.	22MC105	General Aptitude	1/0/0	1	0	0/100	MC
6.	22MC106	Life Skills and Ethics	1/0/0	1	0	0/100	MC
7.	22MC107	Stress Management	1/0/0	1	0	0/100	MC
8.	22MC108	Constitution of India	1/0/0	1	0	0/100	MC
9.	22MC109	Essence of Indian Traditional Knowledge	1/0/0	1	0	0/100	MC
10.	22MC110	Spoken English	1/0/0	1	0	0/100	MC

SEMESTER WISE CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	**22**	**24**	**22**	**22**	**20**	**22**	**23**	**12**	**167**

Total Credits: 167

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **O:** Outside Class hours **Cat.:** Category

HSMC : Humanities and Social Sciences including Management
BSC : Basic Science Courses
ESC : Engineering Science Courses
PCC : Professional Core Courses
PEC : Professional Elective Courses
OEC : Open and Emerging Elective Courses
PRJ : Project Work
INT : Internship
MC : Mandatory Course

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

SEMESTER – VII

22EE701	Power System Protection and Switchgear	3/0/0/3
Nature of Course	D (Theory Application)	
Course Pre-requisites	Transmission and Distribution, Power System Analysis	

Course Objectives:

1	To learn the fundamentals of protective relays used in power systems.
2	To give a broad coverage on types of protective schemes and lighting arresters.
3	To study about the theory of arching and types of circuit breakers.

Course Outcomes:
Upon completion of the course, students shall have ability to

C701.1	Interpret the importance of protective devices in power systems.	[U]
C701.2	Examine the working of various protective relays.	[AN]
C701.3	Apply suitable protection schemes for different apparatus, feeders and bus bar faults.	[AP]
C701.4	Illustrate the causes of overvoltage, overcurrent and its protection methods.	[U]
C701.5	Examine the operation of various circuit breakers with arcing concepts.	[AN]

Course Contents:

Protective Relays **15 Hrs**
Fundamentals of Protection and Switchgear in Power Systems - Types of Relays - Classification of Electromechanical and Induction relays - Operating principle - Applications - Types of Overcurrent Relays - Definite Time, Inverse Time & IDMT Relays - Static Relays and Numerical Relays - Operating principle - Applications.

Apparatus Protection **15 Hrs**
Generator protection - Motor protection - Transformer Protection - Transmission Line Protection - Distance - Differential and Carrier current protection - Feeder - Bus bar protection - Overcurrent protection - Ground Fault protection - Digital Protection of Electrical Apparatus; Wide Area Measurements - Synchronous Phase Measurement Units - Fault location, Identification and Protection.

Circuit Breakers **15 Hrs**
Fault clearing process - Theory of Arcing and Arc quenching - Circuit breakers - Classification - Minimum oil - Air blast - SF6 and Vacuum Circuit Breakers - Case studies on SF6 and Vacuum Circuit Breaker - Recovery Voltage - Current Chopping - Interruption of Capacitive Current - Resistor Switching - Introduction of Miniature Circuit Breakers - Molded Circuit Breakers - Solid state and Hybrid Circuit Breakers.

Total Hours	**45**

Text Books:

1	Paul M. Anderson, Charles Henville, Rasheek Rifaat, Brian Johnson and Sakis Meliopoulos, "Power System Protection", IEEE Press, Wiley, Second Edition, 2022.
2	C.L. Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., Eight edition, 2022.

3	Badri Ram, Vishwakarma “Power System Protection and Switchgear” Tata McGraw Hill, Second edition, 2016.
Reference Books:	
1	Omar Salah Elsayed Atwa, Practical Power System and Protective Relays Commissioning, Academic Press, Elsevier, 2019.
2	Ramesh Bansal, “Power System Protection in Smart Grid Environment”, Taylor and Francis, CRC Press, 2019.
3	Y.G Paithangar, “Fundamentals of Power System Protection” PHI learning Pvt Ltd, Second Edition, 2010.
Web References:	
1.	https://archive.nptel.ac.in/courses/108/107/108107167/
2.	https://www.youtube.com/playlist?list=PLLy_2iUCG87BIJ6ZliVIRCx2Crf9_fJMB
3.	https://www.coursera.org/lecture/mv-substation-part-b/need-and-application-of-surge-arresters-sdefb
4.	https://www.coursera.org/lecture/advanced-study-of-protection-schemes-and-switchgear/bus-protection-schemes-FOlGM
5.	https://www.youtube.com/watch?v=Zx27WM20vhw

22MG702	Engineering Economics		3/0/0/3
Nature of Course	D (Theory Application)		
Course Pre-requisites	Nil		
Course Objectives:			
1	To make the students understand the role of macro and micro Economics for business applications.		
2	To familiarize the students about the cost behaviour in short and long run.		
3	To expose the students to the methods of investment analysis.		
4	To provide the students with an insight in to Indian and International Economics.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C702.1	Understand the needs, roles, scope of Engineering Economics.	[U]	
C702.2	Analyse costs and their role in pricing.	[AN]	
C702.3	Understand the cost behaviour and cost calculations.	[U]	
C702.4	Have working knowledge of investment analysis.	[AN]	
C702.5	Understand the external environment for industries in India and the basics of international business.	[U]	

Course Contents:

Introduction to Economics **15 Hrs**

Economics - Definition, Scope; Micro Economics; Macro Economics; Law of Demand; Law of supply; Types of efficiency- Technical efficiency, Economic efficiency; Types of costs fixed cost vs variable cost, Total cost, Average cost, Marginal cost, opportunity cost, Short run cost, Long run cost, Sunk cost Break - Even analysis.

Investment Analysis **15 Hrs**

Investment aim, purpose, considerations; Time value of money, Capital budgeting - meaning, purpose; Capital expenditure vs Revenue expenditure; Discount rate; Methods of evaluating project feasibility payback period method, Net present value method, Internal rate of return method, Profitability Index Method. Replacement and Maintenance Analysis Types of replacements, Types of maintenance, Determination of Economic life of an asset.

Indian and International Economics **15 Hrs**

Indian Economy Salient features, Planning for Economic - Development of India Five Year Plans, Objectives and achievements; Role of small scale industry, Liberalization, Privatization and Globalization (LPG), International Economics - International trade Purchasing Power Parity Theory; Free Trade Vs Protection; Terms of trade, Balance of Trade, Balance of payment, Exchange Rate Meaning, Factors affecting exchange rates.

Total Hours	**45**

Text Books:

1	Pannerselvam, R., "Engineering Economics, Prentice-Hall of India Pvt. Ltd, New Delhi, 2nd Edition, 2013.

2	Seema Singh, Economics for Engineering Students, I.K. International Publishing House, 2nd edition, 2014.
3	James L. Riggs, David D. Bedworth and Sabah. U. Randhawa, Engineering Economics, TMH Publication, 4th edition, reprint 2004.
Reference Books:	
1	Ruddar daff and K.P.M Sundharam, Indian Economy , S. Chand and Company Ltd, 66th revised edition, 2015.
2	D. R. Kiran, A Textbook of Engineering Economics: The Principles and Applications, BS Publication, 2014
3	Michael R. Lindeburg, Engineering Economic Analysis: An Introduction, Professional Publications, 1993.

Web References:	
1	https://icmai.in/upload/Students/Syllabus2012/Study_Material_New/FoundationPaper1.pdf
2	http://fzp.ujep.cz/~vosatka/ERASMUS/Principles_of_Economics/Principles-of Economics--Mankiw-(5th).pdf
3	https://online.stanford.edu/courses/cee146s-engineering-economics-and-sustainability
4	https://ocw.mit.edu/courses/esd-70j-engineering-economy-module-fall-2009/

22EE904	High Voltage Engineering	3/0/0/3
Nature of Course	G (Theory analytical)	
Pre-requisites	Generation, Transmission and Distribution	

Course Objectives:

1	To expose the students to the basic causes of over voltages in power systems.
2	To describe the fundamentals of breakdown and partial discharge in insulating solid and gas at high voltages.
3	To understand the generation and measurement of high voltages and currents.
4	To understand the concepts of high voltage testing.

Course Outcomes:
Upon completion of the course, students shall have ability to

C904.1	Identify the causes and types of overvoltage.	[U]
C904.2	Examine international standards of designing and testing.	[AN]
C904.3	Infer various breakdown phenomena occurring in gaseous, liquid and solid dielectrics.	[U]
C904.4	Examine the different methods of generating various high voltages and currents.	[AN]
C904.5	Infer the different methods of measuring various high voltages and currents with digital techniques.	[AP]

Course Contents:

Causes of Over Voltages and High Voltage Testing **15 Hrs**
Causes of Over Voltages and its effect on Power System – Lightning, Switching Surges and Temporary Over Voltages – Insulation Co-ordination. High voltage testing of Electrical Power apparatus – Power Frequency, Impulse Voltage and DC testing – International and Indian standards - Design, Planning and Layout of High Voltage Laboratory.

Electrical Breakdown in Gases, Solids and Liquids **10 Hrs**
Basic Gaseous breakdown in Uniform and Non-Uniform Fields – Corona Discharges – Vacuum breakdown - Conduction and Breakdown in Pure and Commercial Liquids – breakdown mechanisms in Solid and Composite dielectrics. Modern Power Systems protection devices, MOA - Metal Oxide Arresters

Generation and Measurement of High Voltages **20 Hrs**
Generation of High DC, AC, Impulse Voltages and Currents. Tripping and control of Impulse Generators. High Voltage DC: Rectifier circuits, Voltage Multipliers, Van-de-graphand Electrostatic Generators. High Voltage AC: Cascaded transformers and Tesla coils. Measurement of High voltages and High Currents and Impulse Current using Sphere Gaps, Peak Voltmeters, Potential Dividers, high speed CRO – Digital techniques in High Voltage Measurement.

Total Hours	**45**

Text Books:

1	C.L. Wadhwa, “Electrical Power Systems”, New Age International (P) Ltd., Eight edition, 2022.
2	Dr.T.Srinivasarao, “High Voltage Engineering”,Notion Press Media Pvt Ltd, January 2022

3	L.L. Alston, “High Voltage Technology”, Oxford University Press, First Indian Edition, 2011.
Reference Books:	
1.	Rakosh Das Begamudre, “High Voltage engineering, Problems and Solutions”, NewAge International Publications, 2010.
2.	Naidu, M.S. and Kamaraju,V., 'High Voltage Engineering', 4th Edition, Tata McGraw- Hill Publishing Company, New Delhi,6th Edition, 2020.
3.	Subir Ray, “An Introduction to High Voltage Engineering”, PHI Learning PrivateLimited, New Delhi, Second Edition, 2013
Web References:	
1	http://nptel.ac.in/courses/108104048/ui/Course_home1_1.html
2	http://www.electrical-engineering-portal.com
3	https://www.youtube.com/watch?v=qqdQqtUp2vw
4	https://www.youtube.com/watch?v=JRbk0_Klhr4

22EE908	Avionics Technology	3/0/0/3
Nature of Course	D (Theory Application)	
Course Pre-requisites	Analog Electronics	

Course Objectives:

1	To acquire the knowledge of aircraft instruments.
2	To provide adequate knowledge of aircraft systems.
3	To understand the aircraft control systems
4	To impart the concept of aircraft navigation and radar systems.

Course Outcomes:
Upon completion of the course, students shall have ability to

C908.1	Interpret the basic components aircraft instrumentation systems	[U]
C908.2	Categorize the different types of aircraft instruments	[AN]
C908.3	Illustrate the concepts of aircraft engine, propulsion systems, structures and cabin system	[U]
C908.4	Examine major components of aircraft control and warning systems	[AP]
C908.5	Infer the aircraft navigation and surveillance systems	[U]

Course Contents:

Aircraft Instruments **15 Hrs**

Flight Instruments and Navigation Instruments - Gyroscope, Accelerometers, Air Speed Indicators – Principles and Operations – True Air Speed (TAS), Equivalent Air Speed (EAS), Mach Meters, Altimeters – Study of various types of engine instruments - Temperature gauges, Pressure gauges - Operation and Principles.

Aircraft Management System **15 Hrs**

Engine systems - Typical examples for piston and jet engines - Fuel management – Lights - Cabin systems - Airframe control and indicating systems - Warning and protection systems - Fire and overheat protection - Terrain awareness warning system (TAWS) - Flight data and cockpit voice recorders.

Aircraft Navigation System **15 Hrs**

Automatic Direction Finders - Errors in Direction Finding - Distance Measuring Equipment - Instrument Landing System - Microwave Landing Systems - Tactical Air Navigation - Ground radar, Surveillance radar, Radar Ground Proximity Warning System - Traffic Collision Avoidance System.

Total Hours | **45**

Text Books:

1	David Wyatt and Mike Tooley, “Aircraft Electrical and Electronics Systems”, Second Edition, Routledge Publishers, 2018.
2	Ian Moir and Allan Seabridge, “Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration”, Wiley India Pvt Ltd, 3rd edition, 2012.
3	Mike Tooley, “Aircraft Digital Electronic and Computer Systems”, Taylor and Francis Ltd, 2013.

Reference Books:

1	David A. Lambardo, “Aircraft Systems”, Tata Mcgraw Hill Education Pvt. Ltd., 2009.
2	Mike Tooley and David Wyatt,”Aircraft Communications and Navigation Systems”, Routledge Publishers, 2013.
3	LalitGupta, O P Sharma, “Fundamentals of Flight Basic Aerodynamics, Aircraft Structures, Aircraft Propulsion, Aircraft Systems”, 1st edition, 2006.

Web References:	
1	https://nptel.ac.in/courses/101104071
2	https://nptel.ac.in/courses/101/108/101108056/
3	https://nptel.ac.in/courses/101101083

22EE917	Embedded Control for Electrical Drives	3/0/0/3
Nature of Course	D (Theory Application)	
Course Pre-requisites	Nil	

Course Objectives:

1	To provide the control concept for electrical drives.
2	To provide knowledge about various embedded system based control strategy for electrical drives
3	To Impart the knowledge of optimization and machine learning techniques used for electrical drives.

Course Outcomes:
Upon completion of the course, students shall have ability to

C917.1	Interpret the significance of embedded control of electrical drives	[U]
C917.2	Deliver insight into various control strategies for electrical drives.	[U]
C917.3	Developing knowledge of Machine learning and optimization techniques for motor control.	[AP]
C917.4	Develop embedded system solutions for real-time application in Electric vehicles.	[AP]
C917.5	Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded system skills required for motor control strategy.	[AN]

Course Contents:

Introduction to Electrical Drives and Overview of Embedded Processor **15 Hrs**
Electric drive and its classifications, Four-quadrant drive, Dependence of load torque on various factors, Dynamics of motor-load combination-Solid State Controlled Drives-Machine learning and optimization techniques for electrical drives- IoT for Electrical drives applications. Embedded Processor architecture.

Induction Motor & BLDC Motor Control **15 Hrs**
Induction Motor Types- Speed control methods - PWM techniques - VSI fed three-phase induction motor- Fuzzy logic Based speed control for three phase induction motor-FPGA based three phase induction motor control.
Overview of BLDC Motor -Speed control methods - PWM techniques - ARM processor based BDLC motor control.

SRM motor control & electric motor drives for electric vehicles control **15 Hrs**
Overview of SRM Motor -Speed control methods -PWM techniques- FPGA based SRM motor control. Design and performance analysis of motor controllers for EVs - Extended speed range operation of electric motors - Regenerative braking control strategy for EV.

Total Hours	**45**

Text Books:

1	R.Krishnan, “Electric Motor Drives – Modeling, Analysis and Control”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2010.

2	Steve Furber, ‘ARM system on chip architecture’, Addision Wesley, 2010
3	Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Willey, 2007
4	Jacek Kabziński "Advanced Control of Electrical Drives and Power Electronic Converters” Springer, 2017.
Reference Books:	
1	Ron Sass and Anderew G.Schmidt, “ Embedded System design with platform FPGAs: Principles and Practices”, Elsevier, 2010.
2	Slobodan N. Vukosavic “Digital Control of Electrical Drives”, Springer, 2011.
3	K. Venkataratnam ,Special Electrical Machines, Universities Press, 2014
Web References:	
1	https://archive.nptel.ac.in/courses/108/104/108104140/
2	https://www.coursera.org/specializations/embedding-sensors-motors
3	https://www.coursera.org/learn/motors-circuits-design
4	https://professional.mit.edu/course-catalog/design-electric-motors-generators-and-drive-systems

22EE915	Embedded Systems for Automotive Applications	3/0/0/3
Nature of Course	D (Theory Application)	
Course Pre-requisites	Nil	

Course Objectives:

1	To Impart knowledge in new developments and advancements in automotive electrical technologies
2	To illustrate the various automobile condition measurement and monitoring mechanisms.
3	To understand the various automatic control systems and basic instrumentation involved in automobiles
4	To analyse the logics of automation & commercial techniques for vehicle communication.

Course Outcomes:

Upon completion of the course, students shall have ability to

C915.1	Illustrate the significance of the role of embedded system for automotive applications.	[U]
C915.2	Illustrate the various sensors, actuators and interfacing techniques.	[U]
C915.3	Develop the embedded concepts for vehicle management and control systems.	[AP]
C915.4	Demonstrate the need of electrical vehicle and able to apply the embedded system technology for various aspects of EVs.	[AP]
C915.5	Improve employability and entrepreneurship capacity due to knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.	[AN]

Course Contents:

Introduction to Automotive Fundamentals and various actuators **15 Hrs**

Automotive Fundamentals – Vehicle functional domains and requirements – The systems approach to control and automotive instrumentation – Sensors and actuators in various vehicle domains. Speed warning systems, oil pressure warning system, engine over heat warning system, air pressure warning system, safety devices - Wind shield wiper and washer, VANET

Power train Electronics with Body Electronic Systems **15 Hrs**

Engine Management Systems: Spark Ignition, Petrol/ Diesel Injection Systems, Transmission Systems. Systems in Chassis control: ABS, ESP, TCS, Active Suspension Systems, Cruise control and adaptive cruise control systems.

Body electronic systems: Power Generation/ Storage, starting motor systems, Vehicle wiring systems, HVAC, Automotive alarm systems, Vehicle immobilization & deactivation, Driver information systems, Parking systems, Central locking system – electric windows.

Autonomous Vehicles and Automotive protocols **15 Hrs**

Occupants and driver safety systems: Seat belt lighteners and air-bags – Diagnostics Systems. Electric/Hybrid Vehicles and their configurations – Autonomous Vehicles and their challenges. Introduction to Embedded automotive protocols: LIN, CAN, FlexRay, MOST - AUTOSAR standard and its applications.

Total Hours	**45**

Text Books:	
1	William B. Ribbens, “Understanding Automotive Electronics - An Engineering Perspective”, Eight Edition, Elsevier Inc., 2017.
2	V. A. W. Hillier and David R. Rogers, “Hillier‟s Fundamentals of Motor Vehicle Technology on Chassis and Body Electronics”, Fifth Edition, Nelson Thrones, 2007.
3	Robert Bosch GmbH, “Bosch Automotive Electrics and Automotive Electronics - Systems and Components, Networking and Hybrid Drive”, Fifth Edition, Springer Vieweg, 2007.

Reference Books:	
1	Joseph Lemieux, “Programming in the OSEK/VDX Environment”, CMP Books, USA, 2001.
2	Tom Denton, “Automobile Electrical and Electronic Systems”, Third Edition, Elsevier Butterworth-Heinemann, 2004.
Web References:	
1	https://www.udemy.com/course/automotive-embedded-systems-applications/
2	https://archive.nptel.ac.in/courses/107/106/107106088/
3	https://www.coursera.org/learn/introduction-to-automotive-embedded-systems
4	https://onlinecourses.nptel.ac.in/noc25_ee31/preview

22EE919	Special Electrical Machines		3/0/0/3
Nature of Course	D (Theory Application)		
Course Pre-requisites	Electrical Machines		
Course Objectives:			
1	To learn the working operation and performance characteristics of Stepper motor.		
2	To realize the performance characteristics of Switched reluctance motors.		
3	To impart knowledge on the performance of Permanent Magnet Brushless DC and Permanent Magnet Synchrono/us motors.		
4	To know about the control strategies of Linear and Servo motor.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C919.1	Enumerate the principle of operation and performance of Stepper motors.	[U]	
C919.2	Analyze the performance of Switched reluctance motors.	[AN]	
C919.3	Apply the principle of Permanent magnet brushless D.C motor in appropriate field.	[AP]	
C919.4	Illustrate the construction and operation of Permanent magnet synchronous motors.	[AP]	
C919.5	Analyze the construction and operation of Linear and Servomotor.	[AN]	

Course Contents:

Stepping Motors and Switched Reluctance Motor **15 Hrs**

Stepping Motors - Constructional features - Principle of operation - Variable reluctance motor - Hybrid motor - Permanent Magnet Stepper motor - Torque equations - Modes of excitations - Characteristics - Microprocessor control of stepping motors - Closed loop control. Switched Reluctance motor: Rotary and Linear SRMs - Constructional features - Principle of operation - Torque production mechanism- Power Converters and their controllers - Methods of Rotor position sensing - Sensor less operation - Closed loop control of SRM.

Permanent Magnet Motors **18 Hrs**

Permanent Magnet Brushless DC motors - Introduction -Principle of operation, Permeance coefficient - Types - Magnetic circuit analysis - EMF and torque equations - Commutation - Power controllers - Motor characteristics and control. Permanent Magnet Synchronous Motor - Principle of operation - Ideal PMSM - EMF and Torque equations - Armature reaction MMF - Synchronous Reactance - Sine wave motor with practical windings - Phasor diagram - Torque/speed characteristics - Power controllers - Converter Volt- ampere requirements. Torque Controllers, Self-control, Vector control, Current control schemes Application aspect related to vehicle and house hold.

Linear and Servomotors **12 Hrs**

Linear Induction motor (LIM) classification - construction - Principle of operation - DC Linear motor (DCLM) types - circuit equation - DCLM control applications. Servomotor-Constructional features, Principle of operation, Types, Characteristics, Control strategies, linear actuators with DC servo motors. Application of linear and servo motor in automation industries. Principle of operation and characteristics of Hysteresis motor - AC series motors - Flux switching and Flux reversal motors.

Total Hours	**45**

Text Books:	
1	Berker Bilgin, James Weisheng Jiang, AliE madi, "Switched Reluctance Motor Drives: Fundamentals To Applications" CRC press,2018.
2	T.J.E.Miller," Switched Reluctance Motors and their Control" Magna Physics Publishing, 2008.
3	Dr.Duanek Hansel man," Brushless Motors: Magnetic Design, Performance, and Control of Brushless DC and Permanent Magnet Synchronous Motors" E-Man Press LLC, 2012.
4	T.Kenjo,S.Nagamori,"Permanent magnet and brushless DC motors" Oxford science publications, 2003.
5	E.G Janardanan, "Special Electrical Machines" Prentice Hall India Learning Private Limited,2014.
Reference Books:	
1	Ahmed Tahor, Abdel Ghani Aissabui," Switched Reluctance Motor- Concept, Control and Applications", In Tech Open, 2017.
2	Riazollah Firoozian,"Servo Motors and Industrial Control Theory" Springer International Publishing AG; 2nd edition, 2014.
3	V.V. Athani," Stepper Motors: Fundamentals, Applications and Design", New Age publisher,2nd edition,2014.
4	R. Krishnan,"Permanent Magnet Synchronous and Brushless DC Motor Drives", T and F India,2016.
Web References:	
1	https://www.elprocus.com/stepper-motor-types-advantages-applications/
2	https://electrical-engineering-portal.com/characteristics-and-work-principles-of switched-reluctance-sr-motor
3	https://www.edn.com/design/sensors/4406682/Brushless-DC-Motors---Part-I--Construction-and-Operating-Principles
4	https://www.simpletecautomatics.com/company-video.html#product
5	http://www.ebs-automation.com/news/video/

22EE909	Nano Technology	3/0/0/3
Nature of Course	C (Theory Concept)	
Course Pre-requisites	Nil	

Course Objectives:

1. To understand the concept of semiconductor devices and materials.
2. To learn about the concepts of Fabrication of Nanomaterials.
3. To impart the concepts of quantum electronics with new device structure
4. To examine various applications of Tunneling effects

Course Outcomes:
Upon completion of the course, students shall have ability to

C909.1	Illustrate the basic concepts of nano electronics.	[U]
C909.2	Examine the fabrication methods and implications.	[AN]
C909.3	Analyze the features of quantum electron devices.	[AN]
C909.4	Appraise FET, RTD and tunneling devices on various nano electronic Devices.	[AN]
C909.5	Demonstrate the concepts of advanced nano electronics devices.	[U]

Course Contents:

Basic of Nano Electronics **15 Hrs**
Introduction to nanotechnology - Impacts - Limitations of conventional microelectronics - Capabilities of nano electronics - Physical fundamentals of nano electronics - Scaling principle - Classification of nano structures - Trends in microelectronics, optoelectronics and nano electronics – Fabrication of nano electronics.

Quantum Electron Devices **15 Hrs**
Quantum particle - Features of quantum electron devices - Quantum dot devices - Quantum wire devices - Electronic structure of material - Low dimensional structures quantum well - Density of states and dimensionality - Electron wavelet propagation - Fundamental limits in computation.

Nano Electronics Devices **15 Hrs**
Field effect transistors - Resonant tunneling diode - Quantum cascade laser - Single electron transistor – High electron transistor - Carbon nanotube devices - MOSFETs – Hetero junction bipolar transistor - Scanning tunneling microscope - Atomic force microscope - Transmission electron microscope - Advanced nano electronics devices - Nanostructured: LEDs, Photo detectors – Introduction to NEMS

Total Hours	**45**

Text Books:

1.	W.R. Fahrner, “Nanotechnology and Nanoelectronics: Materials, Devices, Measurement Techniques”, Springer, 2011.
2.	Edward L. Wolf, “Quantum Nano electronics - An Introduction to Electronic Nanotechnology and Quantum Computing”, Wiley, 2015.
	Chattopadhyay Banerjee, “Introduction to Nano science & Technology”, PHI, 2012.

Reference Books:

1.	S. Datta, “Lessons from Nano electronics: A New Perspective on Transport (Lessons from Nanoscience: a Lecture Notes Series) World Scientific, 2012.
2.	B. R. Nag, “Physics of quantum well devices”, Springer Netherlands, 2015.

3.	V. Mitin, V. Kochelap, and M. Stroscio "Introduction to Nano electronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press, 2008.

Web References:	
1.	https://nptel.ac.in/courses/117108047
2.	https://www.coursera.org/learn/nanotechnology1
3.	https://nanohub.org/courses/FON1

22EE008	Big Data Analytics for Smart Grid	3/0/0/3
Nature of Course	D (Theory application)	
Course Pre-requisites	Power System Analysis, Python Programming	
Course Objectives:		
1	To learn the infrastructure and technologies used in Smart Grid, realize the challenges in Power System and futuristic technologies for improving power system stability.	
2	To impart knowledge on Intelligent data collection devices, Machine learning algorithms for Big Data Analytics.	
3	To know about the Cloud and Edge Computing for Smart Grid Applications.	
Course Outcomes: Upon completion of the course, students shall have ability to		
C008.1	Examine the Challenges and provide Solutions in Power Systems.	[AN]
C008.2	Describe the necessity for Smart Grid, its structure, tools and technologies.	[U]
C008.3	Implement the Machine learning algorithms for Big Data Analytics.	[AP]
C008.4	Illustrate the Potential Applications of Big Data Analytics in Smart Grids.	[AP]
C008.5	Investigate the Edge and Cloud computing solutions for the Smart Grid.	[AN]

Course Contents:

Data Analysis and Data Science in Smart Grid **15 Hrs**

Concepts of Smart Grid - Satellite Communication in Modern Power System - Challenges and Solutions in Power Systems - Need for Big Data Analytics in Smart Grid - Role of PMU in Smart Grid - Emerging Trends and Big Data Analytics at Distribution level Grid - D PMUs: Design and Prototyping - Data Science Pertaining to Smart Grid - Smart Grid Use Cases - Analytics in Smart Grid, Tools and Technologies for Smart Grid.

Machine Learning Algorithms for Big Data Analytics **15 Hrs**

Exploration to machine learning - Logistic Regression - Support Vector Machine - Supervised and Unsupervised Learning - Artificial Neural Network and Models - Demonstration of NN implementation of Time Series of Data in the Google Colab using Python - Implementation of CNN of IMDB Data in Google Colab using Python

Cloud and Edge Computing for SG Applications **15 Hrs**

Cloud computing and cloud analytics - Edge Computing for Smart Grid Applications - Application of CC and EC in the field of system optimization, fault detection, intelligent protection, load analysis, forecasting, security and data management.

Total Hours **45**

Text Books:

1	Shady S. Refaat, Omar Ellabban, Sertac Bayhan, Haitham Abu-Rub, Frede Blaabjerg and Miroslav M. Begovic, “Smart Grid and Enabling Technologies”, Wiley,2021.
2	Bernd M. Buchholz, Zbigniew A. Styczynski “Smart Grids Fundamentals and Technologies in Electric Power Systems of the Future”, Springer Berlin Heidelberg, 2020.
3	Carol L. Stimmel, “Big Data Analytics Strategies for the Smart Grid”, CRC Press, Taylor and Francis,2016.

Reference Books:

1	Chun Sing Lai, Loi Lei Lai, Qi Hong Lai, “Smart Grids and Big Data Analytics for Smart Cities”, Springer International Publishing, 2021.

2	Yi Wang, Qixin Chen, and Chongqing Kang „Smart Meter Data Analytics", Springer Singapore, 2020.
3	Pethuru Raj, S. Koteeswaran, "Novel Practices and Trends in Grid and Cloud Computing", IGI Global, 2019.

Web References:	
1	https://onlinecourses.swayam2.ac.in/arp19_ap60/preview
2	https://www.coursera.org/lecture/electric-utilities/5-2-smart-grid-YUPgW
3	https://online.stanford.edu/courses/xeiet137-smart-grid-sensing-data-analytics-and-control

22EE702	Project - I		0/0/6/3
Nature of Course	Practical		
Pre Requisites	Basics of Electrical Circuits and Analog Electronics		
Course Objectives:			
1	To demonstrate the interpersonal skills and technical abilities.		
2	To apply suitable tools and techniques to solve the practical problems.		
3	To develop a working model		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C702.1	Design and develop a working model.	[C]	
C702.2	Develop technical skill, presentation skill and interpersonal behavior.	[AP]	
C702.3	Demonstrate interdisciplinary skill, ethical values and team work.	[AP]	
C702.4	Examine market trends in terms of economics and finance.	[AP]	

Course Guidelines:

Introduction: Identifying an Innovation Challenge, Needs Finding, Observation Techniques, Techniques for Organizing Data. **Ideate:** Rules of Brainstorming, Brainstorm Facilitation. **Prototype:** Role of DT in your work, Prototyping Techniques, Testing Prototypes. **Experiments:** Introduction to Experimental Design, Types of Experiments, Business model canvass. Introduction and need for intellectual property rights.

1. Each student is expected to do a project and form a team of 3 members.
2. Every team shall have a guide who is the member of the faculty of the institution. Identification of faculty guide has to be completed within a week from the day of beginning of sixth semester.
3. The student has to identify and fabricate his/her idea into the project-working model by conducting literature survey and finalize it.
4. A project report (of the Project -I) to this effect has to be submitted by the team. Also, the complete design project report has to be submitted by team.
5. Three mid semester reviews and one end semester review of the progress of the project work have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of the faculty team.
6. During the end semester exam, one internal examiner and one external examiner, appointed by the COE will examine the Miniproject-I done by the students.

Summative assessment based on Continuous Examination

Activity	Month	Continuous Assessment [100 marks]
Project Evaluation	August	30
Project Evaluation	September	30
Project Evaluation + Presenting in International Conference/Journal	October	40

22EE801	Project - II	0/0/24/12
Nature of Course	Practical	
Pre Requisites	Basics of Electrical Circuits and Analog Electronics	
Course Objectives:		
1	To demonstrate the interpersonal skills and technical abilities.	
2	To apply suitable tools and techniques to solve the practical problems.	
3	To develop a working model	
Course Outcomes: Upon completion of the course, students shall have ability to		
C801.1	Design and develop a working model.	[C]
C801.2	Develop technical skill, presentation skill and interpersonal behavior.	[AP]
C801.3	Demonstrate interdisciplinary skill, ethical values and team work.	[AP]
C801.4	Examine market trends in terms of economics and finance.	[AP]
Course Guidelines:		

Introduction: Identifying an Innovation Challenge, Needs Finding, Observation Techniques, Techniques for Organizing Data. **Ideate:** Rules of Brainstorming, Brainstorm Facilitation. **Prototype:** Role of DT in your work, Prototyping Techniques, Testing Prototypes. **Experiments:** Introduction to Experimental Design, Types of Experiments, Business model canvass. Introduction and need for intellectual property rights.

1. Each student is expected to do a project and form a team of 3 members.
2. Every team shall have a guide who is the member of the faculty of the institution. Identification of faculty guide has to be completed within a week from the day of beginning of sixth semester.
3. The student has to identify and fabricate his/her idea into the project-working model by conducting literature survey and finalize it.
4. A project report (of the Project - I) to this effect has to be submitted by the team. Also, the complete design project report has to be submitted by team.
5. Three mid semester reviews and one end semester review of the progress of the project work have to be conducted by a team of faculty (minimum 3 and a maximum of 5) along with their faculty guide as a member of the faculty team.
6. During the end semester exam, one internal examiner and one external examiner, appointed by the COE will examine the Miniproject-I done by the students.

Summative assessment based on Continuous Examination

Activity	Month	Continuous Assessment [100 marks]
Project Evaluation	January	30
Project Evaluation	February	30
Project Evaluation + Presenting in International Conference/Journal	March	40

22EE902	**Power System Operation and Economics**	**3/0/0/3**
Nature of Course	G (Theory analytical)	
Pre-requisites	Transmission and Distribution, Power System Analysis	

Course Objectives:

1	To learn the concepts of Real Power, Reactive Power, Voltage and Frequency in Power System Operation.
2	To Implement the various control actions and Economic Load Dispatch for Power System Operation and Control.
3	To learn the modern techniques and its application for Real Time Operation and Control of Power Systems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C902.1	Discuss various concepts of Power System Operation and Control.	[U]
C902.2	Analyze Real and Reactive Power control strategies, Voltage and Frequency control methodologies in Single and Multi-Area Systems.	[AN]
C902.3	Interpret the Compensators for Reactive Power Control and various devices used for Voltage Control.	[AP]
C902.4	Analyze Real-Time Economic Generation Scheduling and Unit Commitment problem	[AN]
C902.5	Explain the basic computer control concepts of Power Systems using SCADA and EMS.	[U]

Course Contents:

Module 1: Introduction **9 Hrs**

Power scenario of Indian grid system - National and Regional load dispatching centres -Necessity of Voltage and Frequency regulation - Real Power vs Frequency, Reactive Power vs Voltage Control loops - System Load Variation, Load Curves - Load Forecasting - Computational methods in Load Forecasting - Load Shedding and Islanding - Deregulation - Basics of Electrical Energy Tariff. Economic Decision making in Power System Planning.

Module 2: Real Power, Reactive Power, Voltage and Frequency Control **18 Hrs**

Basics of Speed Governing mechanisms and modelling - Load Frequency Control (LFC) of Single Area System - Static and Dynamic analysis - LFC of Two Area system -Tie line modelling - Block diagram representation of Two Area system. Tie line with Frequency Bias control - State Variable Model - Generation and Absorption of Reactive Power - Automatic Voltage Regulator (AVR) - Brushless AC excitation system - Block diagram representation of AVR loop static and dynamic analysis - Stability compensation - Tap changing transformer, SVC and STATCOM for Voltage Control.

Module 3: Economic Operation and Computer Aided Control of Power Systems **18Hrs**

Economic Dispatch Problem – Input and Output characteristics of Thermal Plant - Incremental cost curve – Optimal operation of thermal units without and with Transmission losses- Lambda - Iteration method - Base point and Participation Factor methods. Statement of Unit Commitment (UC), problem Constraints on UC problem - Solution of UC problem using priority list - Computer control of Power System - Energy Control centers and functions. Data Acquisition and Controls - System hardware configurations - SCADA and EMS functions.

Total Hours	**45**

Text Books:	
1.	Kyaw Myo Lin, “Power System Operation and Control”, Trans Ltd., New Delhi, Second Edition, 2024.
2.	Olle. I. Elgerd, ‘Electric Energy Systems theory – An introduction’, McGraw Hill Education Pvt. Ltd., New Delhi, 2nd edition, 2017.
3.	Kundur P., ‘Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 12th reprint, 2015.
Reference Books:	
1.	Kothari D.P. and Nagrath I.J., ‘Power System Engineering’, Tata McGraw– Hill Education, Second Edition, Reprint 2018.
2.	Hadi Saadat, ‘Power System Analysis’, McGraw Hill Education Pvt. Ltd., New Delhi, 23rd reprint, 2015.
3.	Allen. J. Wood and Bruce F. Wollen berg, ‘Power Generation, Operation and Control’, John Wiley & Sons, Inc., 3rd edition, 2013.
Web References:	
1.	https://nptel.ac.in/courses/108/104/108104052/
2.	https://nptel.ac.in/courses/108/101/108101040/
3.	https://www.youtube.com/watch?v=JRbk0_Klhr4
4.	https://www.youtube.com/watch?v=qqdQqtUp2vw
5.	https://www.youtube.com/watch?v=3l_UN9TQ1Qg

22EE921	Servo Drives in Robotics		3/0/0/3
Course Pre-requisites	Electrical Machines - I and Electrical Machines - II		
Nature of Course	D (Theory Application)		
Course Objectives:			
1	To impart the knowledge of servo motors drives and power transmission.		
2	To understand the concepts of sensors and vision systems.		
3	To understand the concepts of robots in various industries for automation.		
Course Outcomes: **Upon completion of the course, students shall have ability to**			
C921.1	Interpret the basic laws and concepts of robots.		[U]
C921.2	Explain the concepts of servo mechanisms.		[U]
C921.3	Analyze the sensor systems to the robotic system.		[AN]
C921.4	Analyze the vision systems in the robotic system.		[AN]
C921.5	Apply the Robots in Manufacturing and Processing Industries.		[AP]
Course Contents:			

Module 1: Fundamental concepts of Robotics and Servo motor Drives **15Hrs**

Robot definitions - Robotics systems and robot anatomy - Structure of a Robot, Classification of Robots: Cartesian, Cylindrical, Spherical, Articulated, SCARA - Specification of Robots - Degrees of freedom of serial and parallel manipulators. **Servomotor**: Types - Constructional features - Principle of operation - Feedback system - Sizing of servomotors.

Module 2: Sensors and Vision Systems **20Hrs**

Principle of operation, types and selection of position and velocity sensors, Potentiometers, Encoders, Resolvers, LVDT, Tacho-generators, Internal and External State Sensors, Proximity sensors. Limit switch -Tactile sensors - Touch sensors - Force and torque sensors, Robot end effectors. **Vision Systems:** Vision Systems for Robotics: Robot vision systems, Image capture - solid state cameras - Image Representation - Grey scale and colour images, Image sampling and quantization - Image processing and analysis - Image data reduction Segmentation

Module 3: Factory Automation **10Hrs**.

Factory Automation: Flexible Manufacturing Systems concept - Automatic feeding lines, transfer lines, automatic inspection - Computer Integrated Manufacture - CNC, intelligent automation. HMI Systems, DCS and SCADA, Wireless controls.

		Total Hours	**45**

Text Books:

1.	Sotiris Makris “ Cooperating Robots for Flexible Manufacturing”, Tata McGraw Hill Publishing, 2020.
2.	Ulrich Rembold, “Robot Technology and Applications”, CRC Press, 2020.
3.	Saeed B Niku, “Introduction to Robotics Analysis, Systems, Applications”, PHI Pvt Ltd, New Delhi, 2016.
4.	Peter Corke, “Robotics, Vision and Control: Fundamental Algorithms In MATLAB” first edition 2011.

Reference Books:

1.	S K Saha – “Introduction to Robotics,” Tata Mcgraw Hill, 2010.
2.	Mittal R K, Nagrath I J, “Robotics and Control,” Tata McGraw Hill, 2010.
3.	Richard D Klafter, Thomas A Chmielewski, Michael Negin, “Robotics Engineering -An Integrated Approach”, Eastern Economy, Prentice Hall of India Pvt Ltd., 2010.
Online Reference:	
1.	https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/
2.	https://www.edx.org/course/robotics-columbiax-csmm-103x
3.	https://www.futurelearn.com/courses/begin-robotics

22EE925	Industrial Electrification using Renewable Energy System		3/0/0/3
Nature of Course	D (Theory Application)		
Pre-requisites	Nil		
Course Objectives:			
1	To provide the knowledge regarding the energy consumption pattern in agro based industries and quantification techniques		
2	To provide the knowledge regarding the identification of opportunities for renewable energy sources in industrial Electrification.		
CourseOutcomes: **Upon completion of the course, students shall have ability to**			
C925.1	Infer the need of industrial electrification and the energy conversion		[U]
C925.2	Interpret the working of Solar energy system in industrial electrification		[U]
C925.3	Analyze the technologies in Solar energy system in industrial electrification		[AN]
C925.4	Infer suitable applications for wind energy system in industrial electrification		[AP]
C925.5	Infer suitable applications for bio energy system in industrial electrification		[AP]
CourseContents:			

Module 1: Industrial Electrification 15 Hrs

Elucidation of unit operations in industry. Energy quantification techniques, system boundary, estimation of productivity, plant capacity utilization, energy density ratio and energy consumption pattern. Energy flow diagram and conservation opportunities identification.

Module 2: Solar Energy System in Industrial Electrification 15 Hrs

Solar energy for industrial application: Solar water heating, steam solar cooking system, industrial solar dryer and solar process heat, solar cooling system (refrigeration, air conditioning and solar architecture technology), solar furnace and solar greenhouse technology for high-tech cultivation. Solar photovoltaic technology for industrial power.

Module 3: Wind and Bio Energy System in Industrial Electrification 15 Hrs

Wind energy: Aero generator of new era and national and international state of art in wind power generation. Other renewable energy sources: Magneto hydro dynamics, fuel cells technology and micro-hydro energy technology.

Bio energy: Bio energy for industrial application: Quantification of industrial bio-waste, characterization, power generation through bio-methanation, gasification and dendro thermal power plant.

		TotalHours	**45**
TextBooks:			
1	Duffie JA and Beakman WA. 2006. Solar Energy Thermal Process. John Wiley and Sons, New York		

2	Kumar S. 2011. Energy Conservation Building User Code Guide. Bureau of Energy Efficiency, New Delhi.
3	Rathore NS, Kurchania AK and Panwar NL. 2007. Non- Conventional Energy Sources Himanshu Publications, Udaipur, Rajasthan.
ReferenceBooks:	
1	Sayigh AAM. 2012. Solar Energy Engineering. Academic Press, New York.
2	Singh P, Kurchania AK, Rathore NS and Mathur AN. 2005. Sustainable Development through Renewable Energy Sources. Yash Publications, Bikaner, Rajasthan
WebReferences:	
1	https://onlinecourses.swayam2.ac.in/nou23_es03/preview
2	https://www.coursera.org/learn/wind-energy
3	https://www.edx.org/course/solar-energy-delftx-et3034x-0

22EE932	Vehicle Design and Fabrication	3/0/0/3
Nature of Course	C (Theory Concept)	
Course Pre-requisites	Electrical Machines – I	

Course Objectives:

1	To know the concepts of Electric Vehicle mechanics and Battery modeling.
2	To impart the knowledge of Testing Electric Motor and Controllers.

Course Outcomes:

Upon completion of the course, students shall have ability to

C932.1	Illustrate the Electric Vehicle Standardization.	[U]
C932.2	Examine the Performance of Electric Vehicle Mechanics	[AN]
C932.3	Interpret the Battery Modelling, Types and Charging for Electric Vehicle.	[U]
C932.4	Analyze the Performance of Electric motors and controllers by various Testing Methods.	[AN]
C932.5	Infer the different testing procedure of Electric Vehicle.	[U]

Course Contents:

Module 1: EV Standardization **10 Hrs**

Introduction - Current status of standardization of electric vehicles, electric Vehicles and Standardization - Standardization Bodies Active in the Field – Standardization activities in countries like Japan. The International Electro Technical Commission - Standardization of Vehicle Components.

Module 2: Electric Vehicle Mechanics and Battery Modeling, Types and Charging 20 Hrs

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings- Comparisons of EV with internal combustion Engine vehicles- Fundamentals of vehicle mechanics. Batteries in Electric and Hybrid Vehicles - Battery Basics -Battery Parameters. Types- Lead Acid Battery - Nickel-Cadmium Battery - Nickel-Metal-Hydride (NiMH) Battery - Li-Ion Battery - Li-Polymer Battery, Zinc-Air Battery, Sodium-Sulphur Battery, Sodium-Metal-Chloride, Research and Development for Advanced Batteries. Battery Modelling, Electric Circuit Models. Battery Pack Management, Battery Charging.

Module 3: Testing of Electric Motors And Controllers For Electric And Hybrid Electric Vehicles **15 Hrs**

Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.

Total Hours	**45**

Text Books:

1.	Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005, 1st Edition
2.	Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative, Beate Müller, Gereon Meyer, Springer

	2015, 1st Edition
3	Electric and Hybrid Vehicles, Design Fundamentals, Third Edition, Iqbal Husain, CRC Press, 2021.
Reference Books:	
1	Wie Liu, “Hybrid Electric Vehicle System Modeling and Control”, Second Edition, John Wiley & Sons, 2017, 2nd Edition.
2	Dynamic Simulation of Electric Machinery using MATLAB, Chee Mun Ong, Prentice Hall,1997, 1st Edition
Web References:	
1	https://trimis.ec.europa.eu/roadmaps/vehicle-design-and-manufacturing-vdm
2	https://www.jimcoracing.com/pages/vehicle-design-fabrication?srsltid=AfmBOorJ9iQTb_4YdElqLK4uSz9yjfBD7HQ1AzZs8REcTlQhnVBPBD06
3	https://autoprotoway.com/automotive-design-process/

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