AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR, CHENNAI

AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY
(An Constituent College of Vinayaka Mission's Research Foundation)

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VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

(Constituent Colleges of Vinayaka Mission's Research Foundation, Deemed to be University, Salem, Tamil Nadu, India)

(AICTE APPROVED AND NAAC ACCREDITED)

VINAYAKA MISSION'S
KIRUPANANDA VARIYAR
ENGINEERING COLLEGE

Faculty of Engineering and Technology

REGULATIONS 2017

Programme:

B.E / B.Tech -

ELECTRICAL AND ELECTRONICS ENGINEERING

Full Time (4 Years)

STRUCTURED CHOICE BASED CREDIT SYSTEM (SCBCS)

CURRICULUM AND SYLLABUS

(Semester I to VIII)

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	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.
PO3	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.
PO4	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.
PO5	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.
PO6	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.
PO7	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.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	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.
PO11	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.
PO12	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.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

Graduating Students of Electronics and Communication Engineering programme will be able to:

Sl. No.	Description
PSO 1	Apply science, mathematics and engineering through differential and integral calculus, complex variables to solve electrical engineering problems.
PSO 2	Demonstrate proficiency in use of software and hardware to be required to practice electrical engineering profession.
PSO 3	Provide socially acceptable technical solution with the knowledge of ethical and management principles for sustainable development.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

Sl. No.	Description
PEO1	To impart the graduates to promote basic science and mathematical foundation, as also the principles and technology advancements made in electrical and electronics engineering and allied fields.
PEO2	To induce the graduates to design Electrical, Electronics and Computingsystems those are innovative and socially acceptable.
PEO3	To motivate the graduates to exhibit professionalism, ethics, communicationskills, team work and Application oriented research.

Credit Requirement for the Course Categories

Sl. No.	Category of Courses	Credits to be earned Min – Max.
01	**A. Foundation Courses (FC)**	**54 - 81**
	i. Humanities and Sciences (English and Management Courses)	12 – 21
	ii. Basic Sciences (Maths, Physics and Chemistry Courses)	24 – 33
	iii. Engineering Sciences (Basic Engineering Courses)	18 - 27
02	**B. Core courses (CC) relevant to the chosen Programme of study.**	**81**
03	**C. Elective Courses (EC)**	**18 - 24**
	i. Programme Specific (Class Room or Online)	12 – 15
	ii. Open Elective (Class Room or Online)	6 - 9
04	**D. Project + Internship + Industry Electives (P + I + I)**	**18**
	i. Project	9
	ii. Internship	3
	iii. Industry Supported Courses	6
05	**E. Employability Enhancement Courses + Co - Curricular Courses + Extra Curricular Courses	**9 - 18**
	i. Employability Enhancement Courses (Personality Development Training, Participation in Seminars, Professional Practices, Summer Project, Case Study etc.)	3 - 6
	ii. Co - Curricular Courses (NCC, NSS, Sports, Games, Drills and Physical Exercises)	3 - 6
	iii. Extra Curricular Courses	3 - 6
	Minimum Credits to be earned	**180**

**** - Mandatory, Credits would be mentioned in Mark sheets but not included for CGPA Calculations. For overall CGPA calculations, a student has to earn minimum 171 credits in Categories A to D.**

CURRICULUM

B.E / B.Tech. ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER
I TO VIII

B.E/B.Tech. – ELECTRICAL AND ELECTRONICS ENGINEERING - SEMESTER I TO VIII									
CATEGORY A – FOUNDATION COURSES - HS, BS AND ES COURSES - CREDITS (54-63)									
(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT SUBJECTS) - CREDITS (12 - 21)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.	17EGHS01	TECHNICAL ENGLISH	ENGLISH	FC (HS)	3	0	0	3	NIL
2.	17EGHS02	BUSINESS ENGLISH	ENGLISH	FC (HS)	3	0	0	3	NIL
3.	17EGHS81	ENGLISH LANGUAGE LAB	ENGLISH	FC (HS)	0	0	4	2	NIL
4.	17YMHS82	YOGA & MEDITATION	PHYSICAL EDUCATION	FC (HS)	0	0	4	2	NIL
5.	17MBHS04	TOTAL QUALITY MANAGEMENT	MANAGEMENT	FC (HS)	3	0	0	3	NIL
6.	17MBHS01	ENGINEERING STARTUPS AND ENTREPRENERIAL MANAGEMENT	MANAGEMENT	FC (HS)	3	0	0	3	NIL
(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY SUBJECTS) - CREDITS (24 - 33)									
1.	17MABS01	ENGINEERING MATHEMATICS	MATHEMATICS	FC (BS)	2	2	0	3	NIL
2.	17PCBS02	PHYSICAL SCIENCES	PHYSICS & CHEMISTRY	FC (BS)	4	0	0	4	NIL
3.	17MABS06	DIFFERENTIAL EQUATIONS AND TRANSFORMS	MATHEMATICS	FC (BS)	2	2	0	3	ENGINEERING MATHEMATICS
4.	17PHBS05	SMART MATERIALS	PHYSICS	FC (BS)	3	0	0	3	NIL
5.	17MABS10	PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	MATHEMATICS	FC (BS)	2	2	0	3	DIFFERENTIAL EQUATIONS AND TRANSFORMS
6.	17MABS16	NUMERICAL METHODS	MATHEMATICS	FC (BS)	2	2	0	3	ENGINEERING MATHEMATICS
7.	17PCBS81	PHYSICAL SCIENCES LAB	PHYSICS & CHEMISTRY	FC (BS)	0	0	4	2	NIL
8.	17CHBS01	ENVIRONMENTAL SCIENCE AND ENGINEERING	CHEMISTRY	FC (BS)	3	0	0	3	NIL
(iii) ENGINEERING SCIENCES (BASIC ENGINEERING COURSES) - CREDITS (18 - 27)									
1	17CSES01	ESSENTIALS OF COMPUTING	CSE	FC(ES)	3	0	0	3	NIL
2	17EEES03	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	EEE & ECE	FC(ES)	4	0	0	4	NIL
3	17CSES05	PROGRAMMING IN PYTHON	CSE	FC(ES)	3	0	0	3	NIL
4	17CMES02	BASICS OF CIVIL AND MECHANICAL ENGINEERING	CIVIL & MECHANICAL	FC(ES)	4	0	0	4	NIL
5	17EEES04	ELECTRIC MACHINERY	EEE	FC(ES)	3	0	0	3	NIL
6	17EEES82	ENGINEERING SKILLS PRACTICE LAB 1. BASIC ELECTRICAL ENGINEERING 2. BASIC ELECTRONICS ENGINEERING	EEE & ECE	FC(ES)	0	0	4	2	NIL
7	17CSES83	PROGRAMMING IN PYTHON LAB	CSE	FC(ES)	0	0	4	2	NIL
8	17CMES81	ENGINEERING SKILLS PRACTICE LAB A. BASIC CIVIL ENGINEERING B. BASIC MECHANICAL ENGINEERING	CIVIL & MECHANICAL	FC(ES)	0	0	4	2	NIL
9	17MEES84	ENGINEERING GRAPHICS (THEORY + PRACTICE)	MECHANICAL	FC(ES)	1	0	4	3	NIL

B.E./B.TECH. – ELECTRICAL AND ELECTRONICS ENGINEERING - SEMESTER I TO VIII										
CATEGORY B – CORE COURSES RELEVANT TO THE PROGRAMME - CREDITS (81)										
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**	**PAGE NO**
1.	17EECC01	ELECTRIC CIRCUIT ANALYSIS	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	53
2.	17ECCC20	SEMICONDUCTOR DEVICES AND CIRCUITS	ECE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	55
3.	17EECC02	ELECTRICAL MACHINES – I	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	57
4.	17EECC03	ELECTRO MAGNETIC THEORY	EEE	CC	3	0	0	3	NIL	59
5.	17EECC04	MEASUREMENTS AND INSTRUMENTATION	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	61
6.	17EECC05	ELECTRICAL MACHINES – II	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	63
7.	17ECCC05	DIGITAL LOGIC CIRCUITS & DESIGN	ECE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	65
8.	17EECC06	POWER ELECTRONICS	EEE	CC	3	0	0	3	SEMICONDUCTOR DEVICES AND CIRCUITS	67
9.	17EECC07	TRANSMISSION & DISTRIBUTION	EEE	CC	3	0	0	3	NIL	69
10.	17EECC08	CONTROL SYSTEMS	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	71
11.	17EECC09	POWER SYSTEM ANALYSIS	EEE	CC	3	0	0	3	NIL	73
12.	17ECCC10	LINEAR INTEGRATED CIRCUITS	ECE	CC	3	0	0	3	SEMICONDUCTOR DEVICES AND CIRCUITS	75
13.	17ECCC07	MICROCONTROLLERS & ITS APPLICATIONS	ECE	CC	3	0	0	3	NIL	77
14.	17EECC10	POWER SYSTEM OPERATION AND CONTROL	EEE	CC	3	0	0	3	POWER SYSTEM ANALYSIS	79
15.	17EECC11	SOLID STATE DRIVES	EEE	CC	3	0	0	3	POWER ELECTRONICS	**81**
16.	17EECC12	PROTECTION & SWITCHGEAR	EEE	CC	3	0	0	3	ELECTRICAL MACHINES- II	83
17.	17ECCC22	EMBEDDED SYSTEM	ECE	CC	3	0	0	3	NIL	85
18.	17EECC13	HIGH VOLTAGE ENGINEERING	EEE	CC	3	0	0	3	NIL	**87**
19.	17EECC14	ELECTRICAL MACHINES AND DRIVES	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	89
20.	17EECC15	ELECTRICAL TECHNOLOGY	EEE	CC	3	0	0	3	BASICS ELECTRICAL AND ELECTRONICS ENGINEERING	91
21.	17EECC16	POWER ELECTRONICS AND DRIVES	EEE	CC	3	0	0	3	NIL	**93**
22.	17EECC19	ROBOTICS AND AUTOMATION (THEORY & PRACTICE)	EEE	CC	~~3~~	~~0~~	~~0~~	~~3~~	NIL	95
23.	17EECC81	ELECTRIC CIRCUITS LAB	EEE	CC	~~2~~	~~0~~	~~2~~	~~3~~	NIL	97
24.	17ECCC93	SEMICONDUCTOR DEVICES AND CIRCUITS LAB	ECE	CC	~~0~~	~~0~~	~~4~~	~~2~~	NIL	98
25.	17EECC82	ELECTRICAL TECHNOLOGY LAB	EEE	CC	~~0~~	~~0~~	~~4~~	~~2~~	NIL	99

26.	17EECC83	ELECTRICAL MACHINES –I LAB	EEE	CC	~~0~~	~~0~~	~~4~~	~~2~~	NIL	101
27.	17EECC84	MEASUREMENTS AND INSTRUMENTATION LAB	EEE	CC	~~0~~	~~0~~	~~4~~	~~2~~	NIL	102
28.	17EECC85	ELECTRICAL MACHINES - II LAB	EEE	CC	0	0	4	2	NIL	104
29.	17ECCC82	DIGITAL LOGIC CIRCUITS & DESIGN LAB	ECE	CC	0	0	4	2	NIL	106
30.	17EECC86	POWER ELECTRONICS LAB	EEE	CC	0	0	4	2	NIL	107
31.	17ECCC94	LINEAR INTEGRATED CIRCUITS LAB	ECE	CC	0	0	4	2	NIL	109
32.	17EECC87	CONTROL SYSTEMS LAB	EEE	CC	0	0	4	2	NIL	110
33.	17EECC88	POWER SYSTEM SIMULATION LAB	EEE	CC	0	0	4	2	NIL	112
34.	17EECC89	SOLID STATE DRIVES LAB	EEE	CC	0	0	4	2	NIL	114
35.	17ECCC95	MICROCONTROLLERS LAB	ECE	CC	0	0	4	2	NIL	115

B.E./B.TECH. –ELECTRICAL AND ELECTRONICS ENGINEERING - SEMESTER I TO VIII DETAILS OF ELECTIVE COURSES FOR DEGREE WITH SPECIALISATION										
CATEGORY C – ELECTIVE COURSES - CREDITS (18 - 27)										
(i) PROGRAMME SPECIFIC (CLASS ROOM OR ONLINE) - CREDITS (12 - 15)										
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**	**PAGE NO**
1.	17EEEC01	ADVANCED CONTROL SYSTEM	EEE	EC (PS)	3	0	0	3	CONTROL SYSTEMS	117
2.	17EEEC02	ADVANCED TOPICS IN POWER ELECTRONICS	EEE	EC (PS)	3	0	0	3	POWER ELECTRONICS	**119**
3.	17EEEC03	COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS	EEE	EC (PS)	3	0	0	3	NIL	**121**
4.	17EEEC04	EHV AC & DC POWER TRANSMISSION	EEE	EC (PS)	3	0	0	3	TRANSMISSION AND DISTRIBUTION	123
5.	17EEEC05	FLEXIBLE AC TRANSMISSION SYSTEM	EEE	EC (PS)	3	0	0	3	TRANSMISSIO N AND DISTRIBUTION	125
6.	17EEEC06	HIGHVOLTAGE DIRECT CURRENT TRANSMISSION	EEE	EC (PS)	3	0	0	3	TRANSMISSION AND DISTRIBUTION	127
7.	17EEEC07	INTELLIGENT CONTROLLERS	EEE	EC (PS)	3	0	0	3	CONTROL SYSTEMS	129
8.	17ECEC25	MICRO ELECTRO MECHANICAL SYSTEMS	ECE	EC (PS)	3	0	0	3	NIL	**132**
9.	17EEEC09	POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEM	EEE	EC (PS)	3	0	0	3	POWER ELECTRONICS	**134**
10.	17EEEC10	POWER QUALITY	EEE	EC (PS)	3	0	0	3	NIL	136
11.	17EEEC11	POWER SYSTEM PLANNING AND RELIABILITY	EEE	EC (PS)	3	0	0	3	NIL	**138**
12.	17EEEC12	POWER SYSTEM TRANSIENTS	EEE	EC (PS)	3	0	0	3	NIL	140
13.	17EEEC13	SPECIAL ELECTRICAL MACHINES	EEE	EC (PS)	3	0	0	3	ELECTRICAL MACHINES – I & II	142
14.	17EEEC14	WIND ENERGY CONVERSION SYSTEMS	EEE	EC (PS)	3	0	0	3	POWER ELECTRONICS	**144**
15.	17EEEC15	POWER SYSTEM RESTRUCTURING AND DEREGULATION	EEE	EC (PS)	3	0	0	3	POWER SYSTEM OPERATION AND CONTROL	146
16.	17EEEC16	ELECTRIC VEHICLES	EEE	EC (PS)	3	0	0	3	NIL	148
17.	17EEEC17	PHOTOVOLTAIC (PV) ENERGY CONVERSION	EEE	EC (PS)	3	0	0	3	NIL	**150**
18.	17EEEC18	RENEWABLE ENERGY TECHNOLOGY	EEE	EC (PS)	3	0	0	3	NIL	**152**
19.	17EEEC19	DRIVE SYSTEM IN ELECTRIC TRACTION	EEE	EC (PS)	3	0	0	3	NIL	**154**
20.	17EEEC20	MATHEMATICAL MODELLING AND SIMULATION	EEE	EC (PS)	3	0	0	3	NIL	**157**
21.	17EEEC21	NON- CONVENTIONAL ENERGY SOURCES	EEE	EC (PS)	3	0	0	3	NIL	**159**
22.	17EEEC22	SCADA	EEE	EC (PS)	3	0	0	3	NIL	**161**
23.	17EEEC23	PRINCIPLES OF AUTOMATIC CONTROL	EEE	EC (PS)	3	0	0	3	NIL	**163**

SPECIALIZATION IN BIOMEDICAL ENGINEERING										PAGE NO
1.	17BMEC02	BIOTELEMETRY	BME	SE	3	0	0	3	NIL	165
2.	17BMCC03	BIOSENSORS AND TRANSDUCERS	BME	SE	3	0	0	3	NIL	167
3.	17BMEC12	HOSPITAL MANAGEMENT	BME	SE	3	0	0	3	NIL	169
4.	17ECSE12	MEDICAL ELECTRONICS	ECE	SE	3	0	0	3	NIL	171
5.	17BMCC10	MEDICAL IMAGE PROCESSING AND ANALYSIS	BME	SE	3	0	0	3	NIL	173
6.	17BMSE16	WEARABLE TECHNOLOGY	BME	SE	3	0	0	3	NIL	175
7.	17BMCC82	BIOMEDICAL INSTRUMENTATION LAB	BME	SE	0	0	4	2	NIL	177
8.	17ECSE13	BIOMEDICAL IMAGE PROCESSING LAB	ECE	SE	0	0	4	2	NIL	178
9.	17ECSE14	BIOMEDICAL SIGNAL PROCESSING LAB	ECE	SE	0	0	4	2	NIL	180
10.	17ECSE15	DATA ACQUISITION LAB	ECE	SE	0	0	4	2	NIL	182
SPECIALIZATION – POWER SYSTEMS ENGINEERING										
1.	17EESE01	POWER ELECTRONICS IN POWER SYSTEMS	EEE	SE	3	0	0	3	NIL	183
2.	17EESE02	INDUSTRIAL POWER SYSTEM ANALYSIS ANDDESIGN	EEE	SE	3	0	0	3	NIL	185
3.	17EESE03	ARTIFICIAL INTELLIGENCE APPLICATIONSTO POWERSYSTEMS	EEE	SE	3	0	0	3	NIL	187
4.	17EESE04	MODELLINGAND ANALYSIS OF ELECTRICAL MACHINES	EEE	SE	3	0	0	3	NIL	189
5.	17EESE05	TRANSIENTS IN POWER SYSTEM	EEE	SE	3	0	0	3	NIL	191
6.	17CSEC29	TCP/IP TECHNOLOGY	CSE	SE	3	0	0	3	NIL	193
7.	17EESE81	POWER SYSTEM SIMULATION LAB - I	EEE	SE	0	0	4	2	NIL	195
8.	17EESE82	POWER SYSTEM SIMULATION LAB - II	EEE	SE	0	0	4	2	NIL	196
9.	17EESE83	POWER ELECTRONICS SIMULATION LAB -I	EEE	SE	0	0	4	2	NIL	197
10.	17EESE84	POWER ELECTRONICS SIMULATION LAB -II	EEE	SE	0	0	4	2	NIL	199

SPECIALISATION – SOLAR AND ALTERNATE ENERGY											PAGE NO
1.	17EESE06	NON-CONVENTIONAL ENERGY SOURCE AND ITS APPLICATIONS	EEE	SE	3	0	0	3	NIL	200
2.	17SACC05	SOLAR COLLECTORS AND THERMAL ENERGY CONVERSION	EEE	SE	3	0	0	3	NIL	202
3.	17SACC10	ENERGY CONSERVATION AND MANAGEMENT	EEE	SE	3	0	0	3	NIL	204
4.	17EESE07	CONCEPTS OF GREEN BUILDING	EEE	SE	3	0	0	3	NIL	206
5.	17EEEC34	NUCLEAR REACTOR THEORY	EEE	SE	3	0	0	3	NIL	208
6.	17EESE09	CONVENTIONAL AND ALTERNATIVE ENERGY SYSTEMS	EEE	SE	3	0	0	3	NIL	210
7.	17SACC81	SOLAR ENERGY LAB	EEE	SE	0	0	4	2	NIL	212
8.	17SACC82	WIND ENERGY LAB	EEE	SE	0	0	4	2	NIL	214
9.	17EESE83	POWER ELECTRONICS SIMULATION LAB -I	EEE	SE	0	0	4	2	NIL	216
10.	17EESE84	POWER ELECTRONICS SIMULATION LAB -II	EEE	SE	0	0	4	2	NIL	218
(ii) OPEN ELECTIVE (CLASS ROOM OR ONLINE) - CREDITS (6 - 9)										
1.	17ATEC12	FUEL CELL TECHNOLOGY	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	219
2.	17CVEC18	WIND ENGINEERING	CIVIL	EC(OE)	3	0	0	3	NIL	221
3.	17BMCC04	BIOMEDICAL INSTRUMENTATION & MEASUREMENTS	BME	EC(OE)	3	0	0	3	NIL	223
4.	17CSCC01	DATA STRUCTURES	CSE	EC(OE)	3	0	0	3	NIL	225
5.	17CVEC07	DISASTER MITIGATION AND MANAGEMENT	CIVIL	EC(OE)	3	0	0	3	NIL	227
6.	17CSCC04	COMPUTER ARCHITECTURE	CSE	EC(OE)	3	0	0	3	NIL	229
7.	17CSCC19	INTERNET OF THINGS	CSE	EC(OE)	3	0	0	3	NIL	231
8.	17CSEC09	ETHICAL HACKING	CSE	EC(OE)	3	0	0	3	NIL	233
9.	17CSEC11	GREEN COMPUTING	CSE	EC(OE)	3	0	0	3	NIL	235
10.	17ECCC04	SIGNALS AND SYSTEMS	ECE	EC(OE)	3	0	0	3	NIL	237
11.	17ECCC15	ANALOG & DIGITAL COMMUNICATION	ECE	EC(OE)	3	0	0	3	NIL	239
12.	17ECCC17	FPGA SYSTEM DESIGN	ECE	EC(OE)	3	0	0	3	NIL	241
13.	17ECEC02	PCB & PLC	ECE	EC(OE)	3	0	0	3	NIL	243
14.	17ECEC04	DSP WITH FPGA	ECE	EC(OE)	3	0	0	3	NIL	245
15.	17ECEC06	MEMS AND SENSORS	ECE	EC(OE)	3	0	0	3	NIL	247
16.	17ECEC20	ROBOTICS AND AUTOMATION	ECE	EC(OE)	3	0	0	3	NIL	249
17.	17MECC03	ENGINEERING MECHANICS	MECH	EC(OE)	3	0	0	3	NIL	251
18.	17CVCC34	FLUID MECHANICS AND MACHINERY	CIVIL	EC(OE)	3	0	0	3	NIL	253
19.	17MECC16	INDUSTRIAL AUTOMATION	MECH	EC(OE)	3	0	0	3	NIL	255

20.	17MESE30	DESIGN OF THERMAL POWER EQUIPMENTS	MECHANICAL	EC(OE)	3	0	0	3	NIL	257
21.	17MEEC11	INDUSTRIAL ROBOTICS	MECHANICAL	EC(OE)	3	0	0	3	NIL	259
22.	17MEEC13	INDUSTRIAL SAFETY	MECHANICAL	EC(OE)	3	0	0	3	NIL	261
23.	17ATEC02	NEW GENERATION AND HYBRID VEHICLES	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	263
24.	17ATEC04	SPECIAL TYPES OF VEHICLES	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	265
25.	17ATEC06	AUTOMOTIVE SAFETY	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	267
26.	17BMEC09	DESIGN OF MEDICAL DEVICES	BME	EC(OE)	3	0	0	3	NIL	269
27.	17ATEC18	ALTERNATIVE FUELS	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	271
28.	17ECEC21	ADVANCED ROBOTICS	ECE	EC(OE)	3	0	0	3	NIL	273
29.	17MESE09	NEW PRODUCT DEVELOPMENT	MECHANICAL	EC(OE)	3	0	0	3	NIL	275
30.	17MESE22	AUTOMOTIVE INFOTRONICS	MECHANICAL	EC(OE)	3	0	0	3	NIL	277
31.	17MESE23	MICRO AND NANO MACHINING	MECHANICAL	EC(OE)	3	0	0	3	NIL	279
32.	17ATEC10	ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES	AUTOMOBILE	EC(OE)	3	0	0	3	NIL	281
33.	17ECCC11	DATA COMMUNICATION NETWORKS	ECE	EC(OE)	3	0	0	3	NIL	283
34.	17AREC03	UNMANNED AIRCRAFT SYSTEMS	AERO	EC(OE)	3	0	0	3	NIL	285
35.	17CSCC33	PROBLEM SOLVING USING COMPUTER	CSE	EC(OE)	3	0	0	3	NIL	287
36.	17CSCC08	COMPUTER NETWORKS	CSE	EC(OE)	3	0	0	3	NIL	289

B.E/B.TECH. – ELECTRICAL AND ELECTRONICS ENGINEERING - SEMESTER I TO VIII

CATEGORY D – PROJECT + INTERNSHIP + INDUSTRY ELECTIVES (P + I + I)- CREDITS (18)

(i) PROJECT - CREDITS (9)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQSITE	PAGE NO
(i) PROJECT - CREDITS (9)										
1	17EEPI01	PROJECT WORK AND VIVA VOCE	EEE	PI	0	0	18	9	NIL	291
(ii) INTERNSHIP + INDUSTRY ELECTIVES - CREDITS (9)										
1.	17EEPI02	MINIPROJECT	EEE	PI	0	0	6	3	NIL	293
2.	17CSPI07	LEARNING IT ESSENTIALS BY DOING	INFOSYS	PI	3	0	0	3	NIL	295
3.	17CSPI04	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	INFOSYS	PI	3	0	0	3	NIL	297
4.	17EEPI03	VIRTUAL INSTRUMENTATION	NATIONAL INSTRUMENTS	PI	3	0	0	3	NIL	299
5.	17EEPI04	INTRODUCTION TO INDUSTRIAL INSTRUMENTATION	EEE	PI	3	0	0	3	NIL	301

CATEGORY E – EMPLOYABILITY ENHANCEMENT COURSES, CO - CURRICULAR COURSES AND EXTRA CURRICULAR COURSES (EEC) - CREDITS (9 - 18)**

(- MANDATORY, CREDITS WOULD BE MENTIONED IN MARK SHEETS BUT NOT INCLUDED FOR CGPA CALCULATIONS.)**

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE	PAGE NO
(i) EMPLOYABILITY ENHANCEMENT COURSES (EEC)										
1.	17APEE01	PERSONALITY SKILLS DEVELOPMENT – I	MATHS	EE	2 WEEKS OF TRAINING			1	NIL	303
2.	17APEE02	PERSONALITY SKILLS DEVELOPMENT – II	ENGLISH & MANAGEMENT	EE	2 WEEKS OF TRAINING			1	NIL	305
3.	17ECEE01	BASICS ON ELECTRONIC GADGETS, COMPONENTS ASSEMBLING AND SOLDERING	ECE	EE	0	0	2	1	NIL	307
4.	17EEEE01	MATLAB TRAINING	EEE	EE	0	0	4	2	NIL	307
5.	17EEEE02	EMBEDDED SYSTEMS & ROBOTICS TRAINING	EEE	EE	0	0	4	2	NIL	309
6.	17EEEE03	ELECTRICAL MACHINE FAULT DETECTION AND DIAGNOSIS – HANDS ON TRAINING	EEE	EE	0	0	4	2	NIL	310
7.	17EEEE04	POWER PLANT CONTROL AND INSTRUMENTATION	EEE	EE	3	0	0	3	NIL	311
(ii) CO - CURRICULAR COURSES (CCC)										
1.	17APEE03	NCC	NCC CELL	EE	2 WEEKS OF TRAINING IN NCC CAMP			1	NIL	313
2.	17APEE04	NSS	NSS CELL	EE	2 WEEKS OF SOCIAL SERVICE IN NSS CAMP			1	NIL	315
3.	17APEE05	SPORTS AND GAMES (INTER –COLLEGIATE LEVEL)	PHYSICAL EDUCATION	EE	-			1	NIL	317
4.	17APEE06	SPORTS AND GAMES (INTRA-UNIVERSITY LEVEL)	PHYSICAL EDUCATION	EE	-			2	NIL	318
5.	17APEE07	SPORTS AND GAMES (ALL INDIA INTER UNIVERSITY LEVEL)	PHYSICAL EDUCATION	EE	-			3	NIL	319
EXTRA CURRICULAR COURSES										
1.	17ECEE06	EXTRA CURRICULAR COURSE – I	EEE	EE	15 HOURS			1	NIL	
2.	17ECEE07	EXTRA CURRICULAR COURSE – II	EEE	EE	15 HOURS			1	NIL	
3.	17ECEE08	EXTRA CURRICULAR COURSE – III	EEE	EE	15 HOURS			1	NIL	
4.	17ECEE09	EXTRA CURRICULAR COURSE – IV	EEE	EE	15 HOURS			1	NIL	

17EGHS01	TECHNICAL ENGLISH	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE

Technical English is a life skill course necessary for all students of Engineering and Technology. It aims at developing communication skills in English, essential for understanding and expressing the ideas of different professional context. The outcome of the course is to help the students acquire the language skills of Listening, Speaking, Reading and Writing competency in English language and thereby making the students competent and employable in the globalised scenario.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To enable students to develop LSRW skills in English. (Listening, Speaking, Reading, and Writing.)
2	To make them to become effective communicators
3	To ensure that learners use Electronic media materials for developing language
4	To aid the students with employability skills.
5	To motivate students continuously to use English language
6	To develop the students communication skills in formal and informal situations

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Listen, remember and respond to others in different scenario	Remember
CO2. Understand and speak fluently and correctly with correct pronunciation in different situation.	Understand
CO3. To make the students experts in professional writing	Apply
CO4. . To make the students in proficient technical communicator	Apply
CO5. To make the students good communicators at the work place and to be theoretically strong.	Apply
CO6 To make the students recognize the role of technical writing in their careers in business, technical and scientific field	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	**M**			**M**	**M**	**S**		**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO2	**L**	**M**		**L**	**M**	**M**	**S**		**L**	**S**	**S**	**S**			
CO3	**M**	**L**	**L**	**M**			**L**	**L**	**L**	**M**	**S**	**S**		**M**	**M**
CO4		**M**				**M**	**M**		**L**	**S**		**S**	**M**	**S**	**S**
CO5	**M**	**M**		**M**	**M**	**M**	**S**	**M**	**L**	**S**	**M**	**S**	**M**	**S**	**M**
CO6	**M**		**M**			**M**					**S**	**M**	**S**	**M**	**S**

S- Strong; M-Medium; L-Low

SYLLABUS

LISTENING

Self introduction - Simulations using E Materials - Whatsapp, Face book, Hiker, Twitter- Effective Communication with Minimum Words - Interpretation of Images and Films - Identify the different Parts of Speech- Word formation with Prefixes and suffixes -Common Errors in English - Scientific Vocabulary (definition and meaning) - Listening Skills- Passive and Active listening, Listening to Native Speakers - Characteristics of a good listener.

SPEAKING

Articles - Phonetics (Vowels, Consonants and Diphthongs) - Pronunciation Guidelines -Listening to Indian speakers from different regions, intrusion of mother tongue - Homophones – Homonyms - Note taking and Note making - Difference between Spoken and Written English- Use of appropriate language - Listening and Responding to Video Lectures (Green India, environment, social talks) - Extempore.

REPORT WRITING

Tense forms- Verbal and Non verbal Communication - Describing objects - Process Description- Speaking Practice - Paragraph Writing on any given topic (My favourite place, games / Hobbies / School life, etc.) -Types of paragraphs - Telephone Etiquettes - Telephonic conversation with dialogue.

READING

Impersonal Passive Voice - Conditional Sentences - Technical and Non technical Report Writing (Attend a technical seminar and submit a report) - News Letters and Editing - Skimming- Scanning - How to Improve Reading Speed - Designing Invitations and Poster Preparation.

WRITING

Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding (Flow Chart, Bar Chart and Pie Chart) - Informal letters - Resume Writing- Difference between Bio data, Resume and Curriculum Vitae.

TEXTBOOK

1. English for Engineers- Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

REFERENCE BOOKS

1. 1. English for Effective Communication, Department of English, VMKV & AVIT, SCM Publishers, 2009.
2. Practical English Usage- Michael Swan (III edition), Oxford University Press
3. Grammar Builder- I, II, III, and Cambridge University Press.

4 Pickett and Laster. Technical English: Writing, Reading and Speaking, New York: Harper and Row Publications, 2002.

Course Designers:

S.No.	Name of the Faculty	Mail ID
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17EGHS02	**BUSINESS ENGLISH**	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE

Language is one of the most valued possessions of men. It acts as a repository of wisdom. Among all other languages English, the international language plays a vital role as a propeller for the advancement of knowledge in different fields and as a telescope to view the dream of the future.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To impart and enhance corporate communication.
2	To enable learners to develop presentation skills
3	To build confidence in learners to use English in Business context
4	To make them experts in professional writing
5	To assist students understand the role of thinking in all forms of communication
6	To equip students with employability and job searching skills

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Communicate with a range of formal and informal context	Understand
CO2. Students will undergo in activities, demonstrating interaction skills and consider how own communication is adjusted in different scenario	Apply
CO3. Strengthening of oral and written skills in the business context	Apply
CO4. Create interest among the students about a topic by exploring thoughts and ideas	Apply
CO5. Make the students to start with pleasing note and make them to give different ideas	Apply
CO6. Make them in better performance in the art of communication	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	**M**		**L**		**L**	**S**	**S**		**M**	**S**		**S**	**S**	**M**	
CO2		**M**	**S**	**M**		**M**	**M**		**L**	**S**		**S**			
CO3	**L**	**M**				**M**		**L**		**S**	**L**	**M**			**M**
CO4		**L**	**M**	**M**			**L**	**M**	**M**	**S**	**L**	**M**	**M**	**S**	
CO5				**M**				**M**	**L**	**S**		**L**	**M**		**M**
CO6		**L**		**M**		**L**	**L**			**S**		**S**		**S**	

S- Strong; M-Medium; L-Low

SYLLABUS

SUBJECT AND VERB AGREEMENT

Subject and Verb Agreement (concord) - Preposition and Relative Pronoun - Cause and effect - Phrasal Verbs-Idioms and phrases-Listening Comprehension -Listening to Audio Files and Answering Questions-Framing Questions-Negotiation Skills-Presentation Skills and Debating Skills.

STRESS

Stress (Word Stress and Sentence Stress) Intonation- Difference between British and American English Vocabulary-Indianism-Compound Words (including Technical Terminology).

READING SKILLS

Reading Skills-Understanding Ideas and making Inferences-Group Discussion-Types of Interviews – FAQs – E - Mail Netiquette - Sample E – mails - Watching Documentary Films and Responding to Questions.

CORPORATE COMMUNICATION

Corporate Communication -Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers - Rearranging Jumbled Sentences - Technical Articles - Project Proposals-Making Presentations on given Topics -Preparing Power Point Presentations

CRITICAL READING

Critical Reading-Book Review-Finding Key Information and Shifting Facts from Opinions-Business Letters (Calling for Quotation, Placing Orders and Complaint Letters) - Expansion of an Idea-Creative Writing.

TEXTBOOK

1. *English for Effective Communication - Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai*

REFERENCE BOOKS

1. Grammar Builder – I, II, III – Cambridge University Press.
2. Technical English – Writing, Reading and Speaking – Pickett and Lester, Harper and Row

Course Designers:

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17EGHS81	ENGLISH LANGUAGE LAB	Category	L	T	P	Credit
		HSS	0	0	4	2

PREAMBLE

English Language Laboratory provides technological support to students. It acts as a platform for learning, practicing and producing language skills through interactive lessons and communicative mode of teaching.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To understand communication nuisances in the corporate sector.
2	To understand the role of mother tongue in second language learning and to avoid interference of mother tongue.
3	To communicate effectively through different activities
4	To understand and apply the telephone etiquette
5	Case study to understand the practical aspects of communication
6	To improve the oral skills of the students

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Give best performance in group discussion and interview	Understand
CO2. Best performance in the art of conversation and public speaking.	Apply
CO3. Give better job opportunities in corporate companies	Apply
CO4. Better understanding of nuances of English language through audio-visual experience and group activities	Apply
CO5. Speaking skills with clarity and confidence which in turn enhances their employability skills	Apply
CO6. Acquire strategic competence to use both spoken and written language in a wide range of communication strategies	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		S	M	S		L			S	S	M				
CO2	M								M	S		M			M
CO3	M									S		M	M		M
CO4	M									M					M
CO5	M			S						M			M		S
CO6		M	M							M			M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

MODULE I

Ice Breaker, Grouping, Listening- (Hearing and listening)- Active Listening- Passive Listening – Listening to a song and understanding- (fill in the blanks) Telephone Conversation

MODULE II

Influence of mother tongue, videos, understanding nuances of English language (video) puzzle to solve, Activity.

MODULE III

Why is English important, Communication skills, TED (video) Communication in different scenario – a case study, ingredients of success, Activity – chart, speak the design, feedback on progress, Group wise, Individual.

MODULE IV

Telephone Etiquette, Dining Etiquette, Meeting Etiquette.

MODULE V

Case study of Etiquette in different scenario.

Course Designers:

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VINAYAKA MISSION RESEARCH FOUNDATION

AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY , PAIYANOOR

YOGA AND MEDITATION

SYLLABUS- 2018-19

UNIT – I SURYA NAMASKAR AND ASANAS

SuryaNamaskar, Padmasana, Vajrasana, Navasana, Bhujangasana, Dhanurasana, TriKonasana, Uttakatasana, Eka pada pranamasana, Pirai Asana, Padha Hasthasana, Savasana.

UNIT – II PRANAYAMA

Surya pranayama, Chandra Pranayama, Anulom Vilom, Sheetali, Brahmari Pranayama.

UNIT – III MUDRA

Chin mudra, Rughi mudra, Yoga mudra, Maha mudra, Shanmukhi mudra.

UNIT – IV KRIYA

Kapalabathi, Bhastrika.

UNIT – V MEDITATION

Simple, Vibrational, Mantra, Yoga Nitra

References:

1. Dr.V.Krishnamoorthy, *Simple Yoga for Health*, Sri Mathi Nilayam, 2012.
2. Dr.Ananda Balayogi Bhavanani, *A Primer of Yoga Theory*, Dhivyananda Creations,2008.
3. Dr.S.Hema, Easy *Yoga for Beginners*, Tara yoga Publications,2008.
4. Dr.Asana Andiappan, *Ashtanga Yoga*, Asana Publications, 2009.
5. Yogacharya Sundaram, *Sundra Yoga Therapy*, Asana Publications, 2009
6. Dr.John B.Nayagam, *Mudumaikku Mutrupulli Vaikkum Muthiraigal*, Saaru Prabha Publications, 2010.

17MBHS04	TOTAL QUALITY MANAGEMENT	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE:

Quality is the mantra for success or even for the survival of any organization in this competitive global market. Total Quality Management (TQM) is an enhancement to the traditional way of doing business. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach for providing quality of products and processes. It becomes essential to survive and grow in global markets, organizations will be required to develop customer focus and involve employees to continually improve Quality and keep sustainable growth.

PREREQUISITE: NIL

COURSE OBJECTIVES:

1. To understand the Total Quality Management concepts.
2. To practice the TQM principles.
3. To apply the statistical process control
4. To analyze the various TQM tools
5. To adopt the quality systems.

COURSE OUTCOMES:

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

CO1: Understand the importance of quality and TQM at managerial level.	Understand
CO2: Practice the relevant quality improvement tools to implement TQM.	Apply
CO3: Analyse various TQM parameters with help of statistical tools.	Analysing
CO4: Assess various TQM Techniques.	Evaluate
CO5: Practice the Quality Management Systems in a different organization Environment.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	L	L	L	M	L	M	-	-	-
CO2	M	-	-	-	L	L	-	L	M	M	-	L	-	-	M
CO3	S	S	M	S	S	-	-	L	-	L	-	L	L	M	L
CO4	L	M	S	L	M	-	L	-	L	M	L	M	-	-	-
CO5	L	L	M	-	L	M	S	S	M	L	L	M	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

Quality: Definition - Dimensions - Planning- costs – Analysis Techniques for Quality Costs- Basic concepts of Total Quality Management- Historical Review- Principles - Leadership – Concepts- Role of Top Management- Quality Council – Quality Statements- Strategic Planning- Deming Philosophy- TQM Implementation – Barriers.

TQM PRINCIPLES

Customer satisfaction – Perception of Quality- Complaints- Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment - Teams- Recognition and Reward- Performance Appraisal- Benefits- Continuous Process Improvement – Juran’s Trilogy- PDSA Cycle- 5S – Kaizen - Basic Concepts.

STATISTICAL PROCESS CONTROL (SPC)

The Seven tools of Quality- Statistical Fundamentals – Measures of central Tendency & Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

TQM TOOLS

Benchmarking – Reasons - Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Taguchi Quality Loss Function- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA.

QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems- ISO 9000:2000 Quality System – Elements- Implementation of Quality System- Documentation- Quality Auditing- QS 9000- ISO 14000 – Concept- Requirements and Benefits.

TEXT BOOKS:

1. Dale H.Besterfiled- et at. - Total Quality Management- PHI-1999. (Indian reprint 2002).
2. Feigenbaum.A.V. “Total Quality Management- McGraw-Hill- 1991.

REFERENCES:

1. James R.Evans & William M.Lidsay - The Management and Control of Quality- (5th Edition) - South-Western (Thomson Learning) - 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. “Total Quality Management Butterworth – Hcinemann Ltd - Oxford. 1989.
3. Narayana V and Sreenivasan - N.S. Quality Management – Concepts and Tasks- New Age International 1996.

COURSE DESIGNERS:

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17MBHS01	**ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT**	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE:

A startup means company initiated by individual innovator or entrepreneurs to search for a repeatable and scalable business model. More specifically, a startup is a newly emerged business venture that aims to develop a viable business model to meet a marketplace needs or wants in an optimum manner.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the basics of Startups Management and components.
2. To analyze the startups fund management practices
3. To practice the various kinds of stocks and employment considerations in startups.
4. To apply the importance of intellectual property rights and its procedures.
5. To explore the entrepreneurial mindset and culture.

COURSE OUTCOMES:

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

CO1: Explain the concept of engineering startups, objectives and functions and its components.	Understand
CO2: Analyze the startups funding issues and remuneration practices in startups business.	Analyse
CO3: Analyze the various kinds of stocks and employment opportunities and consideration in startups business.	Analyse
CO4: Compare and contrast the various forms of intellectual property protection and practice.	Analyse
CO5: Explore the entrepreneurial mindset and culture that has been developing in companies of all sizes and industries.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	M	M	S	-	M	-	M	-	M	L
CO2	S	S	M	M	M	L	-	-	-	-	-	M	L	-	L
CO3	S	S	S	M	M	M	-	-	-	-	-	M	L	M	M
CO4	S	S	S	M	M	M	-	-	-	-	-	M	-	-	L
CO5	S	S	-	M	M	M	-	-	-	-	-	M	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS:

Elements of a successful Start up: Create Management Team and Board of Directors – Evaluate market and Target Customers – Define your product or service –Write your Business Plan

Funding Issues and Remuneration Practices: Funding Issues: Investment Criteria – Looking for seed cash – Seed, Startup, and subsequent Funding Rounds – Milestone Funding - Remuneration Practices for your Start – up : Salaries – Headhunters – Equity Ownership – Form of Equity incentive vehicles – Other compensation – Employment Contracts

Stock Ownership & startup Employment Considerations: Stock ownership: Risk-Reward Scale – Ownership Interest over time – Common and preferred stock – Authorized and outstanding shares – Acquiring stock – Restricted Stock Grants – Future Tax Liability on Restricted Shares - Compensation and startup Employment Considerations : Entrepreneurs Need Insurance – Do Fringe benefits – outsourcing your benefits work – Life Insurance – Health Insurance – Disability Insurance

Protecting Intellectual Property: Protecting your intellectual property: Copyrights - patents–Trade secrets – Trademarks - The Legal Form of your Startup: Corporation – Partnership – Limited Liability Company – Sole Proprietorship - – Making the startup decision: commitment – Leaving a current employer - stay fit.

Entrepreneurship: Entrepreneurship - Introduction to Technology Entrepreneurship and Technology Ventures – Engineers as Entrepreneurs, The Mindset of the Entrepreneurial Leader, Creating and Selling the Entrepreneurial Value Proposition - Essentials of Successful Entrepreneurs – Social environment in entrepreneurial development – Economic environment in entrepreneurial development.

Text Book:

1. *James A. Swanson & Michael L. Baird, "Engineering your start-up: A Guie for theHigh-Tech Entrepreneur" 2nd ed, Professional Publications.inc*
2. *Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.*

Reference Books:

1. *Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.*
2. *Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.*
3. *Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.*
4. *EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad, 1986.*

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID
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2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

Subject Code 17MABS01	ENGINEERING MATHEMATICS	Category	L	T	P	Credit
		BS	2	2	0	3

PREAMBLE

The driving force in Engineering Mathematics is the rapid growth of technology and is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To identify the characteristics of a linear system with Eigen values and Eigen vectors.
2	To improve their ability in solving geometrical applications of differential calculus
3	To find a maximum or minimum value for a function of several variables subject to a given constraint.
4	To understand the integration techniques for evaluating surface and volume integrals.
5	Incorporate the knowledge of vector calculus to support their concurrent and subsequent engineering studies

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Able to understand the system of linear equations arising in all engineering fields using matrix methods.	Understand
CO2. Determine the evolute and envelope for a given family of curves	Apply
CO3. Apply differentiation to solve maxima and minima problems.	Apply
CO4. Compute the area and volume of plane using integration	Apply
CO5. Evaluate the surface and volume integral using Green's, Stokes and Gauss Divergence theorems	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PS O3
CO1	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO2	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

MATRICES: Characteristic equation – Eigen values and eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors (Without proof) – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form.

DIFFERENTIAL CALCULUS: Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature – Evolute.

FUNCTIONS OF SEVERAL VARIABLES: Partial Derivatives – Total Differentiation – Maxima and Minima constrained Maxima and Minima by Lagrangian Multiplier Method.

MULTIPLE INTEGRALS: Double integration – change of order of integration – Cartesian and polar coordinates – Area as a double integral – Triple integration.

VECTOR CALCULUS: Directional derivatives – Gradient, Divergence and Curl – Irrotational and solenoidal – vector fields – vector integration – Green's theorem, Gauss divergence theorem and Stoke's theorem (excluding proof).

TEXT BOOKS:

1. "Engineering Mathematics I & II", Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).
2. Dr.A.Singaravelu, "Engineering Mathematics I & II", 23rd Edition, Meenakshi Agency, Chennai (2016).

REFERENCES:

1. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Education Pvt, New Delhi (2011).
2. Grewal B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
3. Kreyszig E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore (2012).
4. Kandasamy P, Thilagavathy K, and Gunavathy K., "Engineering Mathematics", Volumes I & II (10th Edition).

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Dr.G.Selvam	Asso.Prof	VMKVEC	selvam@vmkvec.edu.in
2	Ms.S.Gayathri	Asst.Prof.Grade I	AVIT	gayathri@avit.ac.in

17PCBS02	PHYSICAL SCIENCES PART A - ENGINEERING PHYSICS	Category	L	T	P	Credit
		BS	2	0	0	2

PREAMBLE

Engineering Physics is the study of advanced physics concepts and their applications in various technological and engineering domains. Understanding the concepts of laser, types of lasers, thepropagation of light through fibers, applications of optical fibers in communication and different types of non-destructive techniques will help an engineer to analyze, design and to fabricate various conceptual based devices.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To recall the properties of laser and to explain principles of laser
2	To assess the applications of laser
3	To detail the principles of fiber optics
4	To study the applications of fiber optics
5	To explain various techniques used in Non-destructive testing

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand the principles laser, fiber optics and non-destructive testing	Understand
CO2. Understand the construction of laser, fiber optic and Non-Destructive testing equipments	Understand
CO3. Demonstrate the working of laser, fiber optic and Non-Destructive testing based components and devices	Apply
CO4. Interpret the potential applications of laser, fiber optics and Non-Destructive testing in various fields.	Apply
CO5. Differentiate the working modes of various types of laser, fiber optic and Non-Destructive testing based devices.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	M	-	-	-	-	-	-	-	-	M	M	-	-
CO2	S	-	L	-	-	-	-	-	-	-	-	M	M	-	-
CO3	S	-	-	M	-	-	M	-	-	-	-	M	M	-	-
CO4	S	M	-	M	M	S	M	-	-	-	-	M	S	-	-
CO5	S	M	M	-	-	-	-	-	-	-	-	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT-I

LASERS: Laser characteristics - Stimulated Emission – Population Inversion - Einstein coefficients – Lasing action – Types of Laser – Nd:YAG laser, CO_2 laser, GaAs laser – Applications of Laser – Holography – construction and reconstruction of a hologram

UNIT-II

FIBRE OPTICS: Principle and propagation of light in optical fibers – numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – Applications: Fiber optic communication system – fiber optic displacement sensor and pressure sensor.

UNIT-III

NON-DESTRUCTIVE TESTING: Introduction – Types of NDT - Liquid penetrant method – characteristics of penetrant and developer - ultrasonic flaw detector – X-ray Radiography: displacement method – X-ray Fluoroscopy.

TEXT BOOK

1. Engineering Physics, compiled by Department of Physics, Vinayaka Mission's Research Foundation (Deemed to be University), Salem.
2. P.K. Palanisamy, Engineering Physics, Scientific Publishers, 2011.
3. Dr.M. N. Avadhanulu, Engineering Physics, S.Chand & Co, 2010.

REFERENCE BOOKS

1. Beiser, Arthur, Concepts of Modern Physics, 5th Ed., McGraw-Hill, 2009.

2. Halliday.D, Resnick.R, Walker.J, Fundamentals of Physics, Wiley & sons, 2013.

3. Gaur R. K. and Gupta S. L., Engineering Physics, DhanpatRai publishers, New Delhi, 2001.

4. Avadhanulu.M.N., Arun Murthy.T.V.S, Engineering Physics Vol. I, S.Chand, 2014.

5. Rajendran. V, Engineering Physics, Tata McGraw Hill Publication and Co., New Delhi, 2009.

6. Baldev Raj et al. Practical Non-Destructive Testing, Narosa Publications, 2017.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. SENTHIL KUMAR	PROFESSOR	PHYSICS	senthilkumarc@vmkvec.edu.in
2	Dr. R. SETHUPATHI	ASSOCIATE PROFESSSOR	PHYSICS	sethupathi@vmkvec.edu.in
3	Dr. G. SURESH	ASSOCIATE PROFESSSOR	PHYSICS	suresh.physics@avit.ac.in
4	Dr. B.DHANALAKSHMI	ASSOCIATE PROFESSSOR	PHYSICS	dhanalakshmi.phy@avit.ac.in

17PCBS02	**PHYSICAL SCIENCES** **PART B -ENGINEERING CHEMISTRY** **Semester I (Common to All Branches)**	Category	L	T	P	C
		BS	2	0	0	2

Preamble

Objective of this course is to present a better understanding of basic concepts of chemistry and its applications on different engineering domains. It also imparts knowledge on fundamentals of Electrochemistry, Energy storage technologies, properties of water and its treatment methods, classification of fuels, Non conventional sources of Energy and various advanced Engineering materials.

Prerequisite

Not required

Course Objectives

1	To impart basic knowledge in Chemistry so that the student will understand the engineering concept
2	To familiar with electrochemistry and Battery and fuel Cells
3	To lay foundation for practical applications of water softening methods and its treatment methods in engineering aspects.
4	To inculcate the knowledge of fuels and advanced material.

Course Outcomes

After the successful completion of the course, learner will be able to

CO1.	Describe the electrochemistry, batteries and working principle of energy storage devices	Understand
CO2.	Estimate the hardness of water	Apply
CO3.	Identify suitable water treatment methods	Analyze
CO4.	Outline the important features of fuels and advanced materials	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO6.	S	M	-	M	-	S	S	S	-	-	L	M	S	-	M
CO7.	S	S	M	-	-	M	M	M	-	-	-	M	-	-	-
CO8.	S	S	M	-	-	M	S	M	-	-	-	M	-		-
CO9.	S	-	-	-	L	L	M	L	-	-	-	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Electrochemistry, Batteries and Fuel cells

Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass) - cells - EMF measurement. Primary battery (Daniel and dry cell) – secondary battery (lead Acid storage battery and Nickel-Cadmiun battery) – Fuel cell (H_2-O_2 fuel cell)

Water Technology and Corrosion

Sources of water – impurities – Hardness and its determination (problems to be avoided) – boiler troubles - water softening (Zeolite & Demineralisation) – Domestic water treatment – Desalination (Electrodialysis & Reverse Osmosis).

Fuels And Chemistry of Advanced Materials

Classification of Fuels (Solid, Liquid, Gaseous, Nuclear and Bio fuels) – Calorific Value of a fuel –Non Petroleum Fuels –Non conventional sources of Energy – combustion.

Basics and Applications:-Organic electronic material, shape memory alloys, polymers (PVC, Teflon, Bakelite)

TEXT BOOKS

1. *Engineering Chemistry by prepared by Vinayaka Mission's Research Foundation, Salem.*

REFERENCE BOOKS

1. *A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi*
2. *Engineering Chemistry by Jain & Jain, 15th edition Dhanpatrai Publishing Company (P) Ltd., New Delhi*
3. *A text book of Engineering Chemistry by Shashi Chawla, Edition 2012 Dhanpatrai & Co., New Delhi.*
4. *Engineering Chemistry by Dr. A. Ravikrishnan, Sri Krishna Publications, Chennai.*

Course Designers:

S. No	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. V. Anbazhagan	Professor	Chemistry	anbu80@gmail.com
2.	Mr. A. Gilbert Sunderraj	Assistant Professor	Chemistry	asmgill80@gmail.com
3.	Dr. R. Nagalakshmi	Professor	Chemistry	nagalakshmi.chemistry@avit.ac.in
4.	Dr.K.Sanghamitra	Associate Professor	Chemistry	sanghamitra.chemistry@avit.ac.in

Subject Code **17MABS 06**	Subject Title **DIFFERENTIAL EQUATIONS AND TRANSFORMS**	Category	L	T	P	Credit
		BS	2	2	0	3

PREAMBLE

Ordinary Differential Equation is used in contrast with the term partial differential equation which may be with respect to more than one independent variable. A real time naturally available signal is in the form of time domain. However, the analysis of a signal is far more convenient in the frequency domain with the help of Transformations. Transform techniques are very important tool in the analysis of signals.

PREREQUISITE

Engineering Mathematics (17MABS01)

COURSE OBJECTIVES

1	To learn ordinary differential equations with constant and variable coefficients
2	To learn Laplace transform and its Inverse method to solve differential Equations and integral transforms
3	To derive a Fourier series of a given periodic function by evaluating Fourier coefficients
4	To calculate the Fourier transform of periodic functions
5	To learn about Z- transforms and its applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Solve differential equations with constant and variable coefficients and Simultaneous first order linear equations with constant coefficients	Apply
CO2. Use the Laplace Transform technique to solve ordinary differential equations.	Apply
CO3. To apply Fourier series methods to solve boundary value problems for linear ODEs.	Apply
CO4. To use the Fourier transform as the tool to connect the time domain and frequency domain in signal processing.	Apply
CO5. To gain the knowledge in Z Transform to the Analysis of Digital Filters and Discrete Signal.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO2	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO3	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO4	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO5	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

ORDINARY DIFFERENTIAL EQUATIONS: Solutions of second and third order linear ordinary differential equation with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

LAPLACE TRANSFORMS: Laplace transform – transform of elementary functions – basic properties – derivatives and integrals of transforms – transforms of derivatives and integrals – initial and final value theorems – Transform of periodic functions-Inverse Laplace transform – Convolution theorem – -Solution of linear ODE of second order with constant coefficients.

FOURIER SERIES: Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

FOURIER TRANSFORMS: Fourier transform pairs - Fourier Sine and Cosine transforms – Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

Z – TRANSFORMS: Z-Transform – Elementary Properties – Inverse Z-Transform – Convolution Theorem – Formation of Difference Equations – Solution of first and second order Difference Equations using Z-Transform.

TEXT BOOKS:

1. *Engineering mathematics I & II ", by Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).*
2. *Dr.A.Singaravelu, "Engineering Mathematics I & II", 23rd Edition, Meenakshi Agency, Chennai (2016).*
3. *Dr.A.Singaravelu, "Transforms and Partial differential Equations", 18^{th} Edition, Meenakshi Agency, Chennai (2013).*

REFERENCES:

1. *Grewal, B.S., "Higher Engineering Mathematics", 42^{nd} Edition, Khanna Publishers, Delhi (2012).*
2. *Kreyszig, E., "Advanced Engineering Mathematics", 8^{th} Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore (2012).*
3. *Veerarajan, T., "Engineering Mathematics I,II and III", Tata McGraw Hill Publishing Co., New Delhi (2011).*

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Dr. M.Vijayarakavan	Asso.Prof	VMKVEC	vijayarakavan@vmkvec.edu.in
2	Dr.A.K.Thamizhsudar	Asso.Prof. grade II	AVIT	thamizhsudar@avit.ac.in

17PHBS05	SMART MATERIALS	Category	L	T	P	Credit
		Basic Sciences	3	0	0	3

PREAMBLE

Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Smart Materials and their applications, Properties of Crystalline Materials & Nanomaterials, Characteristics of Magnetic materials. They also get a clear picture about superconducting materials.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To explain the fundamental properties and classification of smart materials, crystalline materials, Nano materials, Magnetic materials and Super conducting materials.
2	To paraphrase the basic crystalline structure and its properties.
3	To illustrate the synthesis and fabrication of Nano materials.
4	To predict the application of smart materials, crystalline materials, Nano materials, Magnetic materials and Super conducting materials.
5	To analyze the various parameters of crystalline materials.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Restate the properties of various materials.	Understand
CO2. Summarize the various structures of materials.	Understand
CO3. Predict the applications of various materials to designing equipments.	Apply
CO4. Illustrate the properties of materials to designing equipments.	Apply
CO5. Calculate the crystalline parameters of the materials.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	M	S				M			S	S		
CO2	S	M	S	M	S				M			M	S	M	M
CO3	S	S	S	S	S				S			M	S		M
CO4	S	M	S	M	S				M			M	S		M
CO5	M	S	S	M	M				S			M	M		M

S- Strong; M-Medium; L-Low

SYLLABUS

SMART MATERIALS: Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and applications.

CRYSTALLINE MATERIALS: Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures.

NANO MATERIALS: Nanophase materials – Top-down approach - Mechanical Grinding - Lithography - Bottom-up approach – Sol-gel method – Carbon nanotubes – Fabrication – applications.

MAGNETIC MATERIALS: Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials.

SUPERCONDUCTING MATERIALS: Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Applications of superconductors.

TEXT BOOK:

Mani P, Engineering Physics II, Dhanam Publications, 2018.

REFERENCES:

1. Pillai S.O., Solid State Physics, New Age International (P) Ltd., publishers, 2018.

2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2018.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. S. MOHAMMED HARSHULKHAN	Asst.Prof	Physics	harshulkhan@vmkvec.edu.in
2	Mr. R. SAKTHI GANAPATHY	Asst.Prof	Physics	sakthiganapthy@vmkvec.edu.in
3	Dr .G. LATHA	Professor	Physics	latha.physics@avit.ac.in
4	Dr. R. N. VISWANATH	Professor	Physics	viswanath.physics@avit.ac.in

17MABS10	PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	Category	L	T	P	Credit
		BS	2	2	0	3

PREAMBLE

Partial differential equations are applied in many Engineering field like Electromagnetic field, Electronics circuit and fiber optics. It can be solved by various mathematical techniques. The general theory of mathematical systems involving addition and scalar multiplication has the applications to many areas of communication systems. Linear Algebra is used in analog and digital communication system.

PREREQUISITE

Differential Equations and Transforms (17MABS06)

COURSE OBJECTIVES

1	To be familiar with applications of partial differential equations
2	To formulate and solve partial differential equations.
3	To understand the concepts of vector space, linear transformations and diagonalization
4	To apply the concept of inner product spaces in orthogonalization.
5	To compute the linear transformations and find matrices of general linear transformations.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand the basic concepts of linear, non-linear partial differential equations related to Engineering Field	Understand
CO2. Solve partial differential equations arising in engineering problems like wave equations and heat flow equation by Fourier series.	Apply
CO3. Use computational techniques and algebraic skills to compute the dimension of row space and column space for the given vector space.	Apply
CO4. Apply the concept of inner product space in various linear system related problems.	Apply
CO5. Form orthogonal basis and use them to solve engineering problems.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	--	M	M	--	--	--	--	--	--	M	S	M	M
CO2	S	S	--	M	M	--	--	--	--	--	--	M	S	M	M
CO3	S	S	--	M	M	--	--	--	--	--	--	M	S	M	M
CO4	S	S	--	M	M	--	--	--	--	--	--	M	S	M	M
CO5	S	S	--	M	M	--	--	--	--	--	--	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

PARTIAL DIFFERENTIAL EQUATIONS: Formation - Solutions of standard types f(p,q) = 0 , Clairaut's form, f(z,p,q) = 0 , f(p,x) = g(q,y) of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

BOUNDARY VALUE PROBLEMS: Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

VECTOR SPACE AND SUBSPACE: Introduction to vector space and subspace, Linear independent and dependent, spanning set, Basis and dimension, Row space and column space.

INNER PRODUCT SPACES: Inner products, inner product spaces- Cauchy-Schwarz inequality, Linear functional and adjoints, unitary operations and normal operators- spectral theorem.

ORTHOGONALITY AND LINEAR TRANSFORMATION: Introduction to orthogonality, Least square approximation, Orthogonal basis and Gram Schmidt orthogonalisation, Linear transformation and its matrix representation.

TEXT BOOKS:

3. Grewal, B.S., “Higher Engineering Mathematics”, 35th Edition, Khanna Publishers, Delhi, 2012.
4. Kennath M. Hoffman and Ray Kunze, “Linear Algebra”, 2nd Edition, Pearson India Publishing, New Delhi, 2015.
5. M.Artin, “Algebra”, Prentice Hall of India Pvt. Ltd., New Delhi, 2005.

REFERENCES:

5. A.Singaravelu, “Transforms and Partial Differential Equations”, Meenakshi Agencies, Chennai, 2015.
6. Kreyszig, E., “Advanced Engineering Mathematics” (8th Edition), John Wiley and Sons, (Asia) Pvt. Ltd., Singapore, 2000.
7. Dr.Gunadhar Paria, “Linear Algebra”, New Central Book Agency (P) Ltd, 2009.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Mrs.V.T.Lakshmi	Asso.Prof	VMKVEC	lakshmi@vmkvec.edu.in
2	Ms.S.Sarala	Asst.Prof. grade II	AVIT	sarala@avit.ac.in

17MABS16	NUMERICAL METHODS	Category	L	T	P	Credit
		BS	2	2	0	3

PREAMBLE

This course aims at developing the ability to formulate an engineering problem in a mathematical form appropriate for subsequent computational treatment and to choose an appropriate numerical approach. An under graduate of Engineering student needs to know sufficient numerical methods and techniques for solving engineering problems such as static or steady state problems, vibration or stability problems and initial value or transient problems etc.

PREREQUISITE

1.Engineering Mathematics (17MABS01)

2.Differential Equations and Transforms (17MABS06)

COURSE OBJECTIVES

1	To familiar with numerical solution of equations
2	To be get exposed to finite differences and interpolation
3	To be thorough with the numerical Differentiation and integration
4	To find numerical solutions of ordinary differential equations
5	To find numerical solutions of partial differential equations

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Solve the system of linear algebraic equations and single non linear equations arising in the field of Engineering.	Apply
CO2. Apply methods to find intermediate numerical value & polynomial of numerical data.	Apply
CO3. Apply methods to find integration, derivatives of one and two variable functions.	Apply
CO4. Solve the initial value problems using single step and multistep methods.	Apply
CO5. Solve the boundary value problems using finite difference methods.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO2	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO3	S	S	M	M	M	--	--	--	--	--	--	M	S	M	M
CO4	S	S	S	S	M	--	--	--	--	--	--	M	S	M	M
CO5	S	S	S	S	M	--	--	--	--	--	--	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS: Method of false position, Newton-Raphson method for single variable, Solutions of a linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss- Seidel methods. Inverse of a matrix by Gauss-Jordan method. Eigen value of a matrix by Power Method.

INTERPOLATION AND APPROXIMATION: Interpolation with Newton's divided differences, Lagrange's polynomial, Newton forward and backward differences, central difference Formula (Stirling's and Bessel's).

NUMERICAL DIFFERENTIATION AND INTEGRATION: Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal and Simpson's (both 1/3rd and 3/8th) rules. Romberg's rule, Two and Three point Gaussian quadrature formula. Double integrals using Trapezoidal and Simpson's rule.

INITIAL VALUE PROBLEMS OF ODE: Single Step Methods - Taylor Series, Euler and Modified Euler, Runge-Kutta method of fourth order -first and second order differential equations. Multistep Methods - Milne and Adam's-Bash forth predictor and corrector methods.

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS: Finite difference solution for the second order ordinary differential equations, Finite difference solution for one dimensional heat equation (both implicit and explicit). One dimensional wave equation and two dimensional Laplace and Poisson equations.

TEXT BOOKS:

1. S.K Gupta, "Numerical Methods for Engineers", New Age International Pvt. Ltd. Publishers, 2015.
2. S. R. K. Iyengar, R. K. Jain, Mahinder Kumar Jain, "Numerical methods for Scientific and Engineering Computations", New Age International publishers , 6th Edition, 2012.
3. T. Veerarajan, T.Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2004).

REFERENCES:

1. Joe D. Hoffman , Steven Frankel, "Numerical Methods for Engineers and Scientists", 3 rd Edition, 2015,Tata Mc-Graw Hill.(New York).
2. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers", MC Graw Hill Higher Education, 2010.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Name of the college	Mail ID
1	Dr. S.Punitha	Associate Professor	VMKVEC	punitha@vmkvec.edu.in
2	Dr.A.K.Bhuvaneswari	Asst.Prof. grade II	AVIT	bhuvaneswari@avit.ac.in

17PCBS81	PHYSICAL SCIENCES LAB: PART A – REAL AND VIRTUAL LAB IN PHYSICS	Category	L	T	P	Credit
		BS	0	0	2	1

PREAMBLE

In this laboratory, experiments are based on the calculation of physical parameters like young's modulus, rigidity modulus, viscosity of water, wavelength of spectral lines, thermal conductivity and band gap. Some of the experiments involve the determination of the dimension of objects like the size of a microparticle and thickness of a thin wire. In addition to the above real lab experiments, students gain hands-on experience in virtual laboratory.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To impart basic skills in taking reading with precision of physics experiments
2	To inculcate the habit of handling equipments appropriately
3	To gain the knowledge of practicing experiments through virtual laboratory.
4	To know the importance of units
5	To obtain results with accuracy

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO10.	Recognize the importance of units while performing the experiments, calculating the physical parameters and obtaining results	Understand
CO11.	Operate the equipments with precision	Apply
CO12.	Practice to handle the equipments in a systematic manner	Apply
CO13.	Demonstrate the experiments through virtual laboratory	Apply
CO14.	Calculate the result with accuracy	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S													
CO2	S	S	M	M	S				M			M	M		
CO3	S														
CO4	S	S	M	M	S							S	M		
CO5	S	S													

S- Strong; M-Medium; L-Low

SYLLABUS

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating – Spectrometer
7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

LAB MANUAL

Physical Sciences Lab: Part A – Real And Virtual Lab In Physics Manual compiled by Department of Physics, Vinayaka Missions Research Foundation (Deemed to be University), Salem.				
COURSE DESIGNERS				
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17PCBS81	**PHYSICAL SCIENCES** **PART B - ENGINEERING CHEMISTRY LAB** **Semester I (Common to All Branches)**	Category	L	T	P	C
		BS	0	0	2	1

Preamble

The main objective of this course is to develop the intellectual and psychomotor skills of the students by imparting knowledge in water technology and quantitative analysis.

Prerequisite

Not required

Course Objectives

1	To impart basic skills in Chemistry so that the student will understand the engineering concept.
2	To inculcate the knowledge of water and electrochemistry.
3	To lay foundation for practical applications of chemistry in engineering aspects.

Course Outcomes

After the successful completion of the course, learner will be able to

CO1.	Estimate the chemical properties of water	Apply
CO2.	Determine the presence of various elements in the water	Analyze
CO3.	Calculate the strength of acids, oxidizing and reducing agents	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
5.	S	M	M	-	L	M	M	S	-	-	-	M	S	-	M
6.	S	M	M	-	L	M	M	L	-	-	-	M	-	M	-
7.	S	S	M	-	L	M	M	M	-	-	-	M	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Determination of Hardness by EDTA method
2. Estimation of Hydrochloric acid by conductometric method
3. Acid Base titration by pH method
4. Estimation of Ferrous ion by Potentiometric method

5. Determination of Dissolved oxygen by Winkler's method
6. Estimation of Sodium by Flame photometer
7. Estimation of Copper from Copper Ore Solution 8. Estimation of Iron by Spectrophotometer

TEXT BOOKS

2. *Laboratory Manual on Engineering Chemistry prepared by Vinayaka Mission's Research Foundation, Salem.*

REFERENCE BOOKS

1. Laboratory Manual on Engineering Chemistry, K. Bhasin S, Dhanpat Rai Publishing Co Pvt Ltd

Course Designers:

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17CHBS01	**Environmental Science & Engineering (Common to All Branches)**	Category	L	T	P	C
		BS	3	0	0	3

Preamble

Environmental science and Engineering is an interdisciplinary field that integrates physical, chemical, biological, information sciences and provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices. The course helps to create a concern for our environment that will generate pro-environmental action, including activities we can do in our daily life to protect it. Furthermore, it deals the social issues and ethics to develop quality engineer in our country.

Prerequisite

Not required

Course Objectives

1	Applying Science and Engineering knowledge to protect environment
2	To provide comprehensive insight in natural resources and protect natural resources
3	To create awareness on the various pollutions and their impact.
4	To educate the ways and means to manage natural calamities
5	To impart fundamental knowledge on human welfare measures

Course Outcomes:

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

CO1.	Comprehend the impact of engineering solutions in a global and societal context	Understand
CO2.	Illustrate the contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems	Understand
CO3.	Illustrate the importance of ecosystem and biodiversity	Apply
CO4.	Practice to improve the environment and sustainablity	Apply
CO5.	Conclude the importance of conservation of resources.	Analyze
CO6.	Estimate the important role of IT in healthy environment for future generations	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO18.	S	M	-	-	-	M	S	S	M	M	-	S	M	-	S
CO19.	S	-	-	-	-	S	S	S	-	-	-	S	M	-	S
CO20.	S	-	-	-	-	M	S	M	L	-	-	S	M	-	S
CO21.	S	-	-	-	-	M	S	S	M	M	-	S	M	M	S
CO22.	S	-	-	-	-	M	S	S	M	M	-	S	M	M	S
CO23.	S	-	-	-	-	M	S	S	M	M	-	S	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

ENVIRONMENT AND NATURAL RESOURCES
Environment - Definition, scope & importance - Public awareness- Forest resources, mineral resources , water resources, food resources , energy resources (uses, over -exploitation & adverse effects in each case) - Scope & role of environmental engineers in conservation of natural resources - Sustainability development.
ECOSYSTEMS AND BIO – DIVERSITY
Ecosystem - Definition, structure and function - Energy flow -Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity :values and uses, hotspots, threats and conservation.
ENVIRONMENTAL POLLUTION
Pollution - Definition, man made impacts and control measures of air, water and land pollution - Water quality standards & characterization - Importance of sanitation -Nuclear hazards – Hazardous waste management : Solid waste, waste water and biomedical waste - Prevention of pollution and role of individual – Disasters management : Floods, earthquake, cyclone and land slides - Clean technology options.
SOCIAL ISSUES AND ENVIRONMENT
Urban problems related to energy - Water conservation – Resettlement and rehabilitation of people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion-Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board.
HUMAN POPULATION AND ENVIRONMENT
Population growth - Population explosion - Family welfare programme - Environment & human health - Human rights – Value education - Women and child welfare, Role of information technology in environment and human health.
TEXTBOOK
1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.
REFERENCES
1. *Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.* 2. *Bharucha Erach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India* 3. *Trivedi R.K. "Handbook of Environmental Laws", Rules, Guidelines, Compliances and* tandards Vol I & II, Enviro media. 4. *Dr. J. Meenambal, Environmental Science and Engineering, MJP Publication, Chennai* 5. *Gilbert M. Masters : Introduction to Environmental Engineering and Science, Pearson Education Pvt Ltd., II Edition, ISBN 81-297-0277-0, 2004*

Course Designers:

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17CSES01	ESSENTIALS OF COMPUTING	Category	L	T	P	Credit
		ES	3	0	0	3

PREAMBLE

This course aims to provide the fundamental concepts of Computer operations like hardware and software installation, and emphasizing principles application packages. Studying the fundamentals concepts of Algorithms, to resolve the real world application.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To provide basic knowledge of hardware and software components of computers.
2	To introduce and demonstrate various software application packages.
3	To study Problem solving Techniques and program development cycle.
4	To learn about various algorithm and identifying the algorithm efficiency.
5	To learn different algorithm for various application.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To understand the Basic knowledge on hardware and software terminologies.	Understand
CO2. To Demonstrate the various Application Packages like MS-word, MS- Excel etc.	Apply
CO3.To Understand Program Devolvement Cycle and apply various Problem Solving Techniques.	Apply
CO4.To analyze the efficiency of Algorithms.	Analyze
CO5.To Implement of Algorithms for various concepts.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	-	S	-
CO2	S	M	M	-	M	-	-	-	-	-	-	M	-	M	-
CO3	S	S	S	-	M	-	-	-	-	-	-	-	-	-	-
CO4	S	S	S	-	S	-	-	-	-	-	-	-	-	-	-
CO5	S	M	M	-	M	-	-	-	-	-	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF COMPUTER AND INFORMATION TECHNOLOGY: Computer – Generations, Types of Computers, Block diagram of a computer – Components of a computer system –Hardware and software definitions – Categories of software – Booting – Installing and Uninstalling a Software –Software piracy – Software terminologies – Applications of Computer – Role of Information Technology – History of Internet – Internet Services.

SOFTWARE APPLICATIONS: Office Automation: Application Packages – Word processing (MS Word) – Spread sheet (MS Excel) – Presentation (MS PowerPoint).

PROBLEM SOLVING METHODOLOGIES: Problems Solving Techniques - Program Development Cycle – Algorithm Development – Flow chart generation –Programming Constructs (Sequential, Decision-Making, Iteration) – Types and generation of programming Languages.

INTRODUCTION TO ALGORITHMS: Implementation of Algorithms – program verification – The efficiency of algorithms – The analysis of algorithms.

IMPLEMENTATION OF ALGORITHMS: Fundamental Algorithms: Introduction – Exchanging the values of two variables – Counting – Summation of a set of Numbers – factorial computation – Generation of the Fibonacci sequence – Reversing the digits of an integer.

TEXT BOOKS:

1. "Essentials of Computer Science and Engineering", Department of Computer Sciences, VMKVEC, Salem, Anuradha Publishers, 2017.
2. Dromey.R.G, "How to Solve it by Computer", Prentice-Hall of India, 1996.

REFERENCES:

1. Aho.A.V., Hopcroft.J.E and Ullman.J.D, "The Design and Analysis of Computer Algorithms", Pearson Education, 2004.
2. Knuth D.E., "The Art of computer programming Vol 1: Fundamental Algorithms", 3rd Edition, Addison Wesley, 1997.

COURSE DESIGNERS

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17EEES03	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING A. BASIC ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		FC(ES)	2	0	0	2

PREAMBLE

It is a preliminary course which highlights the basic concepts and outline of Electrical engineering. The concepts discussed herein are projected to deliver explanation on basic electrical engineering for beginners of all engineering graduates.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To understand the electrical inventions, basic concepts of AC and DC circuits and basic laws of electrical engineering.
2	To gain knowledge about the working principle, construction, application of DC and AC machines and measuring instruments.
3	To understand the fundamentals of safety procedures, Earthing and Power system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the evolution of electricity, name of the inventors, electrical quantities and basic laws of electrical engineering.	Remember
CO2: Demonstrate Ohm’s and Faraday’s Law.	Apply
CO3: Understand the basic concepts of measuring instruments, electrical machineries and its applications.	Understand
CO4: Analyze the various types of electrical loads, power rating of electrical machineries and energy efficient equipment.	Analyze
CO5: Explain the electrical safety and protective devices.	Understand
CO6: Compare the various types electrical power generation systems by application of conventional and non-conventional sources.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	S	--	--	--	--	--	--	L	M	--	--
CO2	S	M	S	S	--	--	--	--	M	-	--	M	M	L	--
CO3	L	S	L	--	S	--	--	--	--	L	--	L	L	L	--
CO4	S	M	S	L	L	S	S	--	--	S	--	L	M	L	--
CO5	L	M	S	M	--	S	M	M	--	S	--	L	--	--	L
CO6	S	L	S	L	M	S	S	--	--	M	--	L	L	--	L

S- Strong; M-Medium; L-Low

SYLLABUS

HISTORY OF ELECTRICITY, QUANTITIES AND CIRCUITS

Evolution of Electricity and Electrical inventions, Electrical quantities- Charge, Electric potential, voltage, current– DC & AC, power, energy, time period, frequency, phase, flux, flux density, RMS, Average, Peak, phasor & vector diagram. Electric Circuits - Passive components (RLC), Ohm's law, KCL, KVL, Faraday's law, Lenz's law. Electrical materials – Conducting and insulating materials.

MEASURING INSTRUMENT AND ENERGY CALCULATION

Measuring Instruments – Analog and Digital meters – Types and usage. AC and DC Machines & Equipment- Types, Specifications and applications.

Loads – Types of Loads- Power rating and Energy calculation – for a domestic load. Energy Efficient equipments – star ratings.

ELECTRICAL SAFETY AND INTRODUCTION TO POWER SYSTEM

Protection & Safety - Hazards of electricity - shock, burns, arc-blast, Thermal Radiation, explosions, fires, effects of electricity on the human body. Electrical safety practices, Protection devices.

Electric Power- Generation resources, Transmission types & Distribution system (levels of voltage, power ratings and statistics)- Simple layout of generation, transmission and distribution of power.

TEXT BOOKS:

1. Metha.V.K, Rohit Metha, "Basic Electrical Engineering", Fifth Edition, Chand. S&Co, 2012.
2. Kothari.D.P and Nagrath.I. J, "Basic Electrical Engineering", Second Edition, Tata McGraw-Hill, 2009.
3. R.K.Rajput , "Basic Electrical and Electronics Engineering", Second Edition, Laxmi Publication, 2012.
4. P. Selvam, R. Devarajan, A.Nagappan, T. Muthumanickam and T. Sheela"Basic Electrical and Electronics Engineering", First Edition, VMRFDU, Anuradha Agencies, 2017

REFERENCE BOOKS:

1. Smarajt Ghosh, "Fundamentals of Electrical & Electronics Engineering", Second Edition, PHI Learning, 2007.

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17EEES03	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING B. BASIC ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		FC(ES)	2	0	0	2

PREAMBLE

The course aims to impart fundamental knowledge on electronics components, digital logics and communication engineering concepts. The course begins with classification of various active and passive components, diodes and transistors. It enables the student to design small digital logics like multiplexer, demultiplexer, encoder, decoder circuits, etc. It crafts the students to get expertise in modern communication systems.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To learn and identify various active and passive components and their working principles.
2	To understand the number conversion systems.
3	To learn the digital logic principles and realize adders, multiplexer, etc.,
4	To understand the application oriented concepts in the communication systems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Interpret working principle and application of various active and passive electronic components like resistors, capacitors, inductors, diodes and transistors.	Understand
CO2. Construct the rectifiers and regulators circuits and explore their operations.	Apply
CO3. Execute number system conversions and compute several digital logic operations.	Apply
CO4. Design adders, Multiplexer, De-Multiplexer, Encoder, Decoder circuits.	Apply
CO5. Apply the modern technologies in developing application oriented gadgets like the UHD, OLED, HDR.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	--	--	--	--	--	--	M	--	--	--	-	-	-
CO2	S	M	M	M	--	--	M	--	M	--	--	M	-	M	-
CO3	S	M	M	--	--	--	--	--	M	--	--	--	S	-	-
CO4	S	M	M	M	--	--	M	--	M	--	--	M	M	-	-
CO5	S	M	--	--	M	--	M	--	M	M	--	M	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

SEMICONDUCTOR DEVICES

Passive and Active Components - Resistors, Inductors, Capacitors, Characteristics of PN Junction Diode - Zener Diode and its Characteristics - Half wave and Full wave Rectifiers - Voltage Regulation. Bipolar Junction Transistor, JFET, MOSFET & UJT.

DIGITAL FUNDAMENTALS

Number Systems – Binary, Octal, Decimal and Hexa-Decimal – Conversion from one to another – Logic Gates – AND, OR, NOT, XOR, Universal Gates – Adders, Multiplexer, De Multiplexer, Encoder, Decoder – Memories

COMMUNICATION AND ADVANCED GADGETS

Modulation and Demodulation – AM, FM, PM – RADAR – Satellite Communication – Mobile Communication, LED, HD, UHD, OLED, HDR & Beyond, Smart Phones – Block diagrams Only.

TEXT BOOKS:

1. R.K. Rajput, "Basic Electrical and Electronics Engineering”, Laxmi Publications, Second Edition, 2012.
2. Dr.P.Selvam, Dr.R.Devarajan, Dr.A.Nagappan, Dr.T.Muthumanickam and Dr.T.Sheela,“Basic Electrical and Electronics Engineering”, Department of EEE & ECE, Faculty of Engineering & Technology, VMRFDU, Anuradha Agencies, 2018.
3. Edward Hughes, “Electrical and Electronics Technology”, Pearson Education Limited, Ninth Edition, 2005.

REFERENCES:

1. *John Kennedy, "Electronics Communication System", Tata McGraw Hill, 2003.*

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17CSES05	PROGRAMMING IN PYTHON	CATEGORY	L	T	P	CREDIT
		ES	3	0	0	3

PREAMBLE

The purpose of this course is to introduce Python, a remarkably powerful dynamic programming language to write code for different operating systems along with application domain. Python has evolved on more popular and powerful open source programming tool

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To provide basic knowledge on Python programming concepts.
2	To introduce different methods in list, string, tuple, dictionary and sets.
3	To compute different programs using python control statements.
4	To learn about different functions in python.
5	To compute the exception handling functions, file concepts and CSV and JSON.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Learn python statements, comments and indentation, tokens, input and output methods using various example programs.	Understand
CO2. Apply the different methods involved in List, String, Tuples and Dictionary.	Apply
CO3. Design solutions for complex programs using decision making and looping statements.	Apply.
CO4.Apply the function programs with all the concepts like lambda, decorators and generators.	Apply.
CO5. Compute the exception handling programs, file concept programs and understand the concepts of CSV and JSON.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO2	PSO 3
CO1	S	M	M	M	M	-	-	-	-	-	-	-	-	M	M
CO2	S	M	M	M	M	-	-	-	-	-	-	-	M	M	M
CO3	M	S	S	S	M	-	-	-	-	-	-	-	M	M	M
CO4	S	S	S	S	M	-	-	-	-	-	-	-	M	M	M
CO5	S	M	M	M	M	-	-	-	-	-	-	-	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT-1 INTRODUCTION

Introduction to python-Advantages of python programming-Tokens-Variables-Input/output methods-Data types-Operators

UNIT-2 DATA STRUCTURES

Strings-Lists-Tuples-Dictionaries-Sets

UNIT-3 CONTROL STATEMENTS

Flow Control-Selection control Structure-if-if-else-if-elif-else-Nested if iterative control structures-while loop, for loop and range.

UNIT-4 FUNCTIONS

Declaration-Types of Arguments-Fixed arguments, variable arguments, keyword arguments and keyword variable arguments-Recursions-Anonymous functions: lambda- Decorators and Generators.

UNIT-5 EXCEPTION HANDLING

Exception Handling-Regular Expression-Calendars and clock files:File input/output operations-Dictionary operations-Reading and writing in structured files:CSV and JSON.

TEXT BOOKS:

1. *Bill Lubanovic, "Introducing Python Modern Computing in Simple Packages", 1st Edition, O'Reilly Media, 2014.*
2. *Programming With Python Book 'Himalaya Publishing House Pvt Ltd*
3. *"Dive Into Python" by Mark Pilgrim*

REFERENCES:

1. Mark Lutz, "Learning Python", 6th Edition, O'Reilly Media, 2014.
2. David Beazley, Brian K. Jones, "Python Cookbook", 3rd Edition, O'Reilly Media, 2015.
3. Mark Lutz, "Python Pocket Reference", 6th Edition, O'Reilly Media, 2015.

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17CMES02	BASICS OF CIVIL AND MECHANICAL ENGINEERING PART -A BASICS OF CIVIL ENGINEERING (Common to All Branches)	Category	L	T	P	Credit
		ES	2	0	0	2

PREAMBLE

The aim of the subject is to provide a fundamental knowledge of basic Civil Engineering

PREREQUISITE- NIL

COURSE OBJECTIVES

1	To understand the basic concepts of surveying and construction materials.
2	To impart basic knowledge about building components.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. An ability to apply knowledge of mathematics, science, and engineering.	Apply
CO2. An ability to design and conduct experiments, as well as to analyze and interpret data .	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	M	S	-	-	-	-	-	-	M	-	L
CO2	S	M	L	S	M	S	-	-	M	-	-	-	-	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

SURVEYING AND CIVIL ENGINEERING MATERIALS

SURVEYING: Objects – types – classification – principles – measurements of distances – angles – levelling – determination of areas – illustrative examples.

CIVIL ENGINEERING MATERIALS: Bricks – stones – sand – cement – concrete – steel sections.

BUILDING COMPONENTS AND STRUCTURES :

FOUNDATIONS: Types, Bearing capacity – Requirement of good foundations.

SUPERSTRUCTURE: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TEXT BOOKS:

1. “Basic Civil and Mechanical Engineering”, VMU, (2017). Company Ltd., New Delhi,2009

REFERENCES:

1.Ramamrutham S., “Basic Civil Engineering”, Dhanpatrai Publishing Co. (P) Ltd., 2009.
2. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies.

COURSE DESIGNERS

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17CMES02	BASICS OF CIVIL AND MECHANICAL ENGINEERING PART - B BASICS OF MECHANICAL ENGINEERING (Common to All Branches)	Category	L	T	P	Credit
		ES	**2**	**0**	**0**	**2**

PREAMBLE

Basic Mechanical Engineering gives the fundamental ideas in the areas of engineering design, manufacturing and Automobile engineering. An engineer needs to understand, the basic manufacturing techniques and working principle of an Automobile Engineering Components.

PREREQUISITE

NIL

COURSE OBJECTIVE

1	To demonstrate the principles of casting and metal joining processes in manufacturing.
2	To describe and to apply the in depth knowledge in automotive engines and important components.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1. Illustrate the application of casting and metal joining processes in manufacturing	Apply
CO2. Demonstrate the operation of automotive engines and important components	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	L	M	-	-	-	-	-	M	L	-	-
CO2	S	M	L	L	L	M	-	-	-	-	-	M	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

FOUNDRY AND WELDING

Foundry: Introduction to Casting - Types, Pattern- Definition, Function. Foundry tools. Green Sand Moulding application.

Welding: Introduction to welding, Classification – Gas welding, Arc Welding, TIG, MIG, Plasma – Definitions. Arc Welding - Methods and Mechanisms – Applications.

AUTOMOTIVE ENGINES AND COMPONENTS				
Introduction, Two stroke and four stroke cycle – Petrol and Diesel Engines - Construction and working, Fundamentals of automotive components - Brakes, Clutches, Governor, Flywheel, Axles, Drives etc., Fuel supply systems, Exhaust emission and control.				
TEXT BOOKS				
1	Basic Civil and Mechanical Engineering, School of Mechanical Engineering Sciences, VMU, Salem			
REFERENCE BOOKS				
1	K.Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai			
2	NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida			
3	TJ.Prabu, Basic Mechanical Engineering, SCITECH Publications, Chennai			
COURSE DESIGNERS				
S.No	**Faculty Name**	**Designation**	**Dept / College**	**Email id**
1	S. Duraithilagar	Associate Professor	Mech / VMKVEC	sduraithilagar@vmkvec.edu.in
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17EEES04	ELECTRIC MACHINERY	Category	L	T	P	Credit
		FC(ES)	3	0	0	3

Preamble

In a modern world the electrical motors plays a vital role in all the applications especially in bio medical field its employed in various medical and health care equipments such as patient handling equipment, compressors, respirators, pacemakers, defibrillators , exercisers, wheelchairs, massage apparatus, therapy equipment, etc. Hence the course provides the knowledge about basic concepts with performance analysis of DC, AC and special electrical machines under different load and unloaded condition as well as the knowledge required for implementation of the above machines in biomedical field.

PREREQUISITE

17EEES03 - Basics of Electrical & Electronics Engineering A. Basic Electrical Engineering

COURSE OBJECTIVES

1	To study the importance of electrical machines in bio medical field and to understand the principle concepts of electro mechanical energy conversion.
2	To understand the concepts of transformer to determine the performance of the device through the equivalent circuit and working principle.
3	To illustrate the construction, operating principle and types of DC machines with its starting and speed control methods.
4	To elucidate the construction, working principle of Synchronous & Induction machine with conventional starting and speed control methods.
5	To describe the construction and principle operation of special electrical machines such as BLDC motor, PMBLDC motor, linear motor and universal motor etc.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Define and understand the concept of electromechanical energy conversion process and easy to implement the concepts to biomedical applications.	Remember
CO2. Identify the parts of transformer, explain the concept and predetermine the performance of the transformer.	Understand
CO3. Categorize the parts of DC machine, describe the concepts of DC machine and analyze the Performance at different loading, un loading conditions and applications.	Analyze
CO4. Implement the concepts of Induction and Synchronous machines to various applications to determine the performance.	Apply
CO5. Choose the suitable special electrical machine and evaluate the performance of the device for biomedical applications.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S	M	L	M	--	--	--	--	M	--	--	--	M	S	S
CO2	M	S	--	--	--	--	--	--	M	--	--	--	M	M	M
CO3	S	S	--	--	--	--	--	--	M	--	--	--	M	--	M
CO4	S	S	--	M	--	--	--	--	M	--	--	--	M	--	M
CO5	S	M	L	M	--	--	--	--	M	--	--	M	S	--	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Need of electrical machines in Bio medical field – Typical applications and requirements of biomedical motors- Electrical Machines – Classification – Basic and Electromagnetic induction Principle – statically induced EMF, Dynamically induced EMF and back EMF – principles of electromechanical energy conversion –Forces and torque - Energy and co energy – Single and Multiple excited systems.

TRANSFORMER
Principle of operation of transformer – Types – Constructional features – EMF equation – Phasor diagram on No Load and Load – Equivalent circuit, Losses and Efficiency of transformer and regulation – OC and SC tests – Predetermination of efficiency and regulation – Autotransformer – Applications.

DC MACHINES
Construction and principle operation of DC machines – EMF equation – Types of DC machines – DC generators – Magnetization and load characteristics of DC generators, DC Motors – Characteristics of DC motors – Armature reaction – Commutation – Voltage and Torque equation - Starting methods of DC machines – Losses and efficiency – Speed control of DC shunt motor –Applications.

INDUCTION MACHINES AND SYNCHRONOUS MACHINES
Construction and Principle of operation of Induction machines – Types - Double revolving field theory – Equivalent circuit of induction machines – Starting methods of induction machines –Speed control of induction machines – Principle of operation of synchronous motor – Different Excitations of synchronous motor – Starting methods – Equivalent circuit- Applications.

SPECIAL ELECTRIC MACHINES
Switched reluctance motor, Stepper motor, Servo motor, BLDC motor, Permanent magnet BLDC motor- Permanent magnet synchronous motor – Universal motor – Hysteresis motor – Linear induction motor – Working principles, Speed-Torque characteristics – Applications.

TEXT BOOKS:
1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 3rd Edition, 2010.
2. B. L. Theraja, A. K. Theraja, "A Text Book of Electrical Technology", Volume II, S.Chand & Company Ltd, New Delhi, 2016.

REFERENCES:
1. Stephen J. Chapman, "Electric Machinery fundamentals", McGraw Hill Education, New Delhi, 5th Edition, 2011.
2. Fitzgerald A.E, Charles Kingsley Jr, Stephen D. Umans, "Electric Machinery", Mc Graw Hill Book Company, 6th Edition, 2005.
3. T. Kenjo and S.Nagomari, "Permanent magnet and brushless DC motors", Clarendon 125 Press, London, 1985.

COURSE DESIGNERS

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1	Mr.G.Ramakrishnaprabu	Associate Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in
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17EEES82	ENGINEERING SKILLS PRACTICE LAB A. BASIC ELECTRICAL ENGINEERING	Category	L	T	P	Credit
		FC(ES)	0	0	2	1

PREAMBLE

It is a laboratory course which familiarizes the basic electrical wiring, measurement of electrical quantities and various types of earthing methods.

PRERQUISITE – NIL

COURSE OBJECTIVES

1	To learn the residential wiring and various types of electrical wiring.
2	To measure the various electrical quantities.
3	To know the necessity and types of earthing and measurement of earth resistance.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO 1: Implement the various types of electrical wiring.	Apply
CO 2: Measure the fundamental parameters of AC circuits.	Analyze
CO 3: Measure the earth resistance of various electrical machineries.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	S	--	--	--	--	--	--	L	M	L	--
CO2	S	M	S	S	--	--	--	--	M	--	--	M	M	L	--
CO3	L	S	L	--	S	--	--	--	--	L	--	L	M	L	--

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

REFERENCES

1. Laboratory Reference Manual.

COURSE DESIGNERS

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1	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
2	Mr. R. Sathish	Assistant Professor	EEE/VMKVEC	sathish@vmkvec.edu.in
3	Ms. D. Saranya	Assistant Professor (Gr-II)	EEE/AVIT	dsaranya@avit.ac.in
4	Mr. S. Prakash	Assistant Professor (Gr-II)	EEE/AVIT	sprakash@avit.ac.in

17EEES82	ENGINEERING SKILLS PRACTICES LAB PART B - BASIC ELECTRONICS ENGINEERING	Category	L	T	P	Credit
		FC(ES)	0	0	2	1

PREAMBLE

This course is to provide a practical knowledge in Basic Electronics Engineering. It starts with familiarization of electronic components and electronic equipments. It enables the students to construct and test simple electronic projects.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To familiarize the electronic components, basic electronic equipments and soldering techniques.
2	To study the characteristics of Diodes, BJT and FET.
3	To understand the principles of various digital logic gates.
4	To understand the concept of basic modulation techniques.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Construct experiments for PN and Zener diode characteristics	Understand
CO2. Demonstrate the fundamentals of soldering techniques.	Apply
CO3. Classify the characteristics of Diodes, BJT and FET.	Apply
CO4. Distinguish between amplitude and frequency modulation techniques.	Apply
CO5. Verify the truth tables of logic gates (AND, OR, NOT, NAND, NOR, XOR).	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	M	-	M	-	-	M	-
CO2	M	M	M	-	-	-	-	-	M	-	M	-	M	-	-
CO3	S	M	-	-	-	-	-	-	M	-	M	-	-	-	-
CO4	S	M	-	-	-	-	-	-	M	-	M	-	M	-	M
CO5	S	M	M	-	-	-	-	-	M	-	M	-	M	-	-

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Identifying Electronics Components.
2. Practicing of Soldering and Desoldering.
3. Characteristics of PN junction Diode.
4. Characteristics of Zener diode.
5. Input & Output characteristics of BJT.
6. Transfer characteristics of JFET.
7. Verification of Logic Gates.
8. Study of Amplitude Modulation.
9. Study of Frequency Modulation.

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1	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
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17CSES83	PROGRAMMING IN PYTHON LAB	Category	L	T	P	Credit
		ES	0	0	4	2

PREAMBLE

This laboratory enables the students clearly understand the basic concepts of python, control statements and file commands in python.

PRERQUISITE

NIL

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Learn Syntax and Semantics and create Functions in Python	Understand
CO2. Handle Strings and Files in Python.	Understand
CO3. Design solutions for complex programs using decision making and looping statements.	Apply
CO4.Understand Lists, Dictionaries in Python.	Apply
CO5. Compute the exception handling programs	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	-	-	M	M
CO2	S	M	L	-	-	-	-	-	-	-	-	-	M	M	M
CO3	S	M	M	-	-	-	-	-	-	-	-	-	M	M	M
CO4	S	M	M	-	-	-	-	-	-	-	-	-	M	M	M
CO5	S	M	M	-	-	-	-	-	-	--	-	-	M	M	M

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Write a program to sum of series of N natural numbers

2. Write a program to calculate simple interest.

3. Write a program to generate Fibonacci series using for loop

4. Write a program to calculate factorial using while loop

5. Write a program to find the greatest of three numbers using if condition

6. Write a program for finding the roots of a given quadratic equation using conditional control statements

7. Write a program to find the greatest of three numbers using conditional operator

8. Write a program to compute matrix multiplication using the concept of arrays

9. Write a program to implement recursive function

10. Write a program to read and write data using file concepts

REFERENCES:

1. Mark Lutz, “Learning Python”, 5th Edition, O'Reilly Media, 2013.
2. David Beazley, Brian K. Jones, "Python Cookbook", 3rd Edition, O'Reilly Media, 2013.
3. Mark Lutz, “Python Pocket Reference”, 5th Edition, O'Reilly Media, 2014.

COURSE DESIGNERS

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1	K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in
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17CMES81	ENGINEERING SKILLS PRACTICE LAB PART A - BASIC CIVIL ENGINEERING (Common to All Branches)	Category	L	T	P	Credit
		ES	0	0	2	2

PREAMBLE

Engineering Skills Practice is a hands-on training practice to Mechanical, Civil and Mechatronics Engineering students. It deals with fitting, carpentry, sheet metal and related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand the basic concepts of surveying and construction materials.
2	To impart basic knowledge about building components.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Prepare the different types of fitting.	Apply
CO2.Prepare the different types of joints using wooden material	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	L	L	L	L	L	L	L	L	L	-	S	-
CO2	S	S	S	L	L	L	L	L	L	L	L	L	L	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

Buildings:

1. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

Plumbing Works:

2. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
3. Study of pipe connections requirements for pumps and turbines.
4. Preparation of plumbing line sketches for water supply and sewage works.
5. Hands-on-exercise: Mixed pipe material connection – Pipe connections with different joining components.
6. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

7. Study of the joints in roofs, doors, windows and furniture.

Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

TEXT BOOK

1. *Basic civil engineering Lab Manual by Department of Civil Engineering,VMRF.*

COURSE DESIGNERS

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1	M.Senthilkumar	Asst.Professor	Civil / VMKVEC	senthilkumar@vmkvec.edu.in
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17CMES81	ENGINEERING SKILLS PRACTICE LAB B. BASIC MECHANICAL ENGINEERING	Category	L	T	P	Credit
		FC(ES)	0	0	2	1

Preamble

Workshop is a hands-on training practice to Mechanical Engineering students. It deals with fitting, carpentry, foundry and welding related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

Prerequisite –NIL

Course Objective

1	To perform the practice in different types of fitting processes.
2	To utilize the different type of joints using wooden materials.
3	To perform and acquire in depth knowledge in metal joining processes.
4	To demonstrate the pattern using foundry processes.

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

CO1.	Identify the different types of fitting using MS plate.	Apply
CO2.	Predict the different types of joints using wooden material	Apply
CO3.	Utilize the different types of joining process in metal by Arc Welding	Apply
CO4.	Make use of different types of green sand mould	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-
CO2	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-
CO3	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-
CO4	S	M	L	L	L	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

LIST OF EXPERIMENTS

Tee – Fitting
Vee – Fitting
Preparation of a mould for a single piece pattern
Preparation of a mould for a split piece pattern
Half- Lap Joint in Carpentry
Dove Tail Joint in Carpentry
Lap Joint – Welding
Butt Joint – Welding

Text Books

1	**BASIC MECHANICAL ENGINEERING, LAB MANUAL**

Reference Books

1	K.Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai
2	NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida

Course Designers

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1	Dr. V. K. Krishnan	Associate Professor	Mech / VMKVEC	vkkrishnan@vmkvec.edu.in
2	B.SELVA BABU	Assistant Professor	Mech/AVIT	selvababu@avit.ac.in

17MEES84	ENGINEERING GRAPHICS (Theory & Practice)	Category	L	T	P	Credit
		FC(ES)	1	0	4	3

Preamble

Engineering Graphics is referred as language of engineers. An engineer needs to understand the physical geometry of any object through its orthographic or pictorial projections. The knowledge on engineering graphics is essential in proposing new product through drawings and interpreting data from existing drawings. This course deals with orthographic and pictorial projections, sectional views and development of surfaces.

Prerequisite – NIL

Course Objective

1	To implement the orthographic projections of points, straight lines, plane surfaces and solids.
2	To construct the orthographic projections of sectioned solids and true shape of the sections.
3	To develop lateral surfaces of the uncut and cut solids.
4	To draw the pictorial projections (isometric and perspective) of simple solids.
5	To sketch by free hand the orthographic views from the given pictorial view.

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

CO1.	To Interpret the physical geometry of any object through its orthographic or pictorial projections	UNDERSTAND
CO2.	Apply in the form of drawing of the orthographic projections of points, straight lines, plane surfaces and solids.	Apply
CO3.	To establish in the form of drawing of the orthographic projections of sectioned solids and true shape of the sections.	Apply
CO4.	Develop lateral surfaces of the solid section and cut section of solids.	Apply
CO5.	Sketch the pictorial projections (isometric and perspective) of simple solids.	Apply
CO6.	To apply free hand sketch of the orthographic views from the given pictorial view.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L	S	L	-	-	-	-	-	-	-	L	-	
CO2	S	S	L	S	L	-	-	-	-	-	-	-	L	-	
CO3	S	S	L	S	L	-	-	-	-	-	-	-	L	-	
CO4	S	M	L	S	S	-	-	-	-	-	-	-	L	-	
CO5	S	S	L	S	L	-	-	-	-	-	-	-	L	-	
CO6	S	S	L	S	L	-	-	-	-	-	-	-	L	-	

S- Strong; M-Medium; L-Low

Syllabus

PLANE CURVES AND FREE HAND SKETCHING

Conics – Construction of ellipse– First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

PROJECTION OF POINTS, LINES

Projection of points, Projection of straight lines located in the first quadrant: inclined to both planes – Determination of true lengths and true inclinations – rotating line method only.

PROJECTION OF SOLIDS

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to any one reference plane by change of position method.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Sectioning of above solids in simple vertical position by cutting planes inclined to any one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids like Prisms, pyramids, cylinders and cones.

ISOMETRIC VIEW AND PERSPECTIVE PROJECTION

Principles of isometric View – isometric scale – isometric view of simple solids- Introduction to Perspective projection

Text Books	
1	Natarajan K V, "Engineering Graphics", Tata McGraw-Hill Publishing Company Ltd. New Delhi.
2	K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Private Limited.
3	K.R.Gopalakrishna"Engineering Drawing" (Vol. I & II), Subhas Publications, 2014.
Reference Books	
1	N.D. Bhat and V.M. Panchal, Engineering Graphics, Charotar Publishers 2013
2	E. Finkelstein, "AutoCAD 2007 Bible", Wiley Publishing Inc., 2007
3	R.K. Dhawan, "A text book of Engineering Drawing", S. Chand Publishers, Delhi,2010.
4	DhananjayA.Jolhe, "Engineering Drawing with an Introduction to AutoCAD", Tata McGraw Hill Publishing Company Limited, 2008.
5	G.S. Phull and H.S.Sandhu, "Engineering Graphics", Wiley Publications, 2014.

Course Designers

S.No	Faculty Name	Designation	Department / Name ofthe College	Email id
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2	Prof. M.SARAVANAN	Asst. Prof	Mech / AVIT	saravanan@avit.ac.in

17EECC01	**ELECTRIC CIRCUIT ANALYSIS**	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Electric circuit theory is the fundamental theory upon which all branches of electrical engineering are built. Many areas of electrical engineering, such as power, electric machines, control, electronics, communications, and instrumentation, are based on electric circuit theory. Therefore, the basic electric circuit theory course is the most important course for an electrical engineering student, and always an excellent starting point for a beginner in electrical engineering education. Circuit theory is also valuable to students specializing in other branches of the engineering because circuits are a good model for the study of energy systems in general, and because of the applied mathematics, physics, and topology involved.

PREREQUISITE

17EES03- Basic of Electrical and Electronics Engineering, 17MABS01 Engineering Mathematics

COURSE OBJECTIVES

1	To understand basic circuit concepts.
2	To study networks and solution of DC and AC circuits.
3	To understand series and parallel resonance concepts and analysis of coupled circuits.
4	To study protection of balanced and unbalanced loads and measurement of power and power factor in three phase circuits.
5	To understand transient analysis of RL, RC and RLC circuits with DC and sinusoidal excitations.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Apply Kirchhoff's current and voltage law to simple circuits and Solve complex circuits using Mesh & Nodal Methods.	Apply
CO2	Apply Network theorems to solve simple and complex linear circuits	Apply
CO3	Solve the Series and Parallel resonance circuit, analyze the performance of single & double tuned circuits.	Analyze
CO4	Explain three phase balanced and unbalanced star, delta network	Understand
CO5	Develop the Transient response of RLC circuits using LaplaceTransform,	Analyze and create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	L	M	L	-	M	S	M	M	S	-	M
CO2	S	S	M	S	L	-	-	-	-	-	-	-	S	M	M
CO3	S	M	-	S	S	-	M	-	M	L	L	M	S	-	-
CO4	M	M	M	M	S	-	M	-	-	L	L	M	S	-	-
CO5	M	M	M	M	S	-	M	-	M	L	L	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC CIRCUIT CONCEPTS

Review of basic concepts- DC & AC circuits - R, L, and C elements phasor diagrams-Complex impedance - Real & Reactive power- Series & Parallel circuits– Formation of matrix equations and analysis of complex circuits using mesh- Current and nodal - Voltage methods.

NETWORK THEOREMS AND TRANSFORMATIONS

Voltage – Current – Source transformation. Star Delta transformation - Superposition theorem – Reciprocity theorem – Substitution theorem – Maximum Power Transfer theorems – Thevenin's theorem – Norton's theorem and Millman's theorem with applications.

RESONANCE AND COUPLED CIRCUITS

Series resonance and parallel resonance – Bandwidth and Q factor. Inductively coupled circuits –Co-efficient of coupling - Dot convention - Multi winding coupled circuits - Analysis of coupled circuits.

THREE PHASE CIRCUITS

Analysis of three phase 3 wire and 4 wire circuits with star and delta connected balanced and unbalanced loads-phasor diagram of Voltages and Currents – Measurement of power and power factor in three phase circuits by using single, two and three Watt meter method.

TRANSIENT ANALYSIS

Transient response – Natural response- forced response – DC response of RL, RC and RLC circuits – sinusoidal response of RL, RC, RLC circuits

TEXT BOOKS

1. Dr.S. Arumugam, Premkumar, Circuit Theory - Khanna publishers,1991
2. Sudhakar, A. and Shyam Mohan S.P.,'Circuits and Network Analysis and Synthesis', Tata McGraw-Hill Publishing C.Ltd., New Delhi, 2006..
3. A Nagoor Kani, Circuit Theory – Sriram publications -2016

REFERENCES

1. Prof. T. Nageswara Rao, "Electric circuit analysis" A.R.Publications.
2. Hyatt, W.H. Jr and Kemmerly, J.E., 'Engineering Circuits Analusis', McGraw-Hill International Editions, 2002.
3. Edminister, J.A., 'Theory and Problems of Electric Circuits', Schaum's outline series McGraw Hill Book Company, 5th Edition, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
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2.	D. SARANYA	Assistant Professor GR-II	EEE/AVIT	dsaranya@avit.ac.in

17ECCC20	SEMICONDUCTOR DEVICES AND CIRCUITS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This is an introduction course to semiconductor devices. The course begins with a discussion on how electron energy bands are formed in semiconductors. It examines the principles and operations of essential semiconductor devices used in today's electronics: diodes, light emitters, bipolar junction transistors and MOSFETs. It includes analysis of small signal model and large signal model of the devices which is the prerequisite for next level courses. This subject helps the students to design, model and develop amplifier circuits, Oscillator circuits, Tuned amplifiers and many other real time application circuits.

PREREQUISITE : 17EEES03 - Basic Electrical and Electronics Engineering

COURSE OBJECTIVES

1	To understand the characteristics of a Semiconductors materials and Diode.
2	To understand the working of transistors and special devices
3	To study the biasing circuits and analyses the small signal BJT/FET amplifiers
4	To understand the working of Feedback Amplifiers and Oscillator circuits.
5	To understand the working and to find the efficiency of different types of Power Amplifiers and Tuned Amplifiers.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the characteristics and applications of Electronic devices such as Semiconductor Diode, Zener diodes.	Understand
CO2. Explain the Configuration and Characteristics of BJT and FET.	Understand
CO3. Demonstrate an appropriate large signal and tuned amplifier by using simulation tools and to obtain its efficiency.	Apply
CO4. Illustrate the applications of various Feedback amplifiers and Oscillator circuits and to obtain the Gain-Bandwidth product.	Apply
C05. Classify the different configuration and obtain the device small signal model of BJTs and FETs using simulation tool.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	-	-	M	-	-	-	-	-	M	L	-	-
CO2	S	M	L	-	-	M	-	-	-	-	-	M	L	-	-
CO3	S	S	M	-	M	-	-	-	-	-	-	M	M	S	-
CO4	S	S	S	M	S	-	-	-	-	-	-	M	M	S	-
CO5	S	S	S	-	S	-	-	-	-	--	-	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

SEMICONDUCTOR MATERIALS AND DIODE APPLICATIONS

Semiconductor materials, Intrinsic Materials, Energy Levels, n-Type and p-Type Materials, Semiconductor Diode and equivalent circuits, Diode Testing, Zener Diodes, Diode current Equation, Light-Emitting Diodes, Half-Wave Rectification, Full-Wave Rectification, Clipper, Clamper, Voltage-Multiplier Circuits, **Practical Applications –** Polarity Insurance, Polarity Detector.

TRANSISTORS & SPECIAL DEVICES

Transistor: Construction, Transistor Operation and characteristics, Common-Base Configuration, Common-Emitter Configuration, Common-Collector Configuration, Limits of Operation, Construction and Characteristics of JFETs, Transfer Characteristics, Depletion-Type MOSFET, Enhancement-Type MOSFET.

Special Devices: SCR, Shockley Diode, Diac, Triac, Unijunction Transistor, Phototransistors, MISFETs, MESFETs, TFETs, HEMTs, Silicon Nano Wire Transistor,

Practical Applications- Current Limiter, Phase shift Oscillator.

BIASING CIRCUITS & SMALL SIGNAL ANALYSIS

BJT Biasing : Operating Point, Fixed Bias Configurations, Emitter Bias Configuration, Voltage Divider Bias Configuration, Emitter Follower Bias Configuration, Hybrid Equivalent model, stability factor, Small Signal Analysis of Single stage BJT Amplifiers.

FET Biasing : Fixed bias, Self bias and Voltage divider bias, FET amplifiers – small signal model and Configurations using simulation tool.

Practical Applications-Random Noise Generator, Sound Modulated Light Source.

FEEDBACK AMPLIFIERS & OSCILLATOR CIRCUITS

Concept of feedback – effects of negative feedback, Types of feedback amplifier-Voltage and Current Series, Voltage and Current Shunt, Gain Bandwidth Product.

Oscillator Circuits: Oscillator Principles – LC oscillators – RC oscillators – Crystal oscillators. **Real time applications**.

POWER AMPLIFIERS & TUNED AMPLIFIERS

Power Amplifier : Class A, Push –Pull Amplifier-Class B, Class C & D amplifiers, Amplifier Distortion, Amplifier Efficiency.

Tuned amplifiers : Single tuned, Double tuned, Synchronous tuned amplifiers –Stability of Tuned Amplifiers using simulation tool.

Real Time Applications of Amplifiers – Outdoor Musical Systems, Video Amplification.

TEXT BOOKS:

1.Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill,4th Edition, 2015.

2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Edition, 2013.

REFERENCE BOOKS:

1. *David A Bell, "Fundamentals of Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.*
2. *D.Roy choudhury and shail B.Jain, ―Linear Integrated circuits‖, 4th edition, New Age International Pvt. Ltd, 2014.*
3. *Thomas L. Floyd, "Electronic Devices", 9th edition, Pearson Education, 2011.*

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4	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

17EECC02	ELECTRICAL MACHINES-I	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Electrical Machines – I is concerned with the constructions, analysis of characteristics, testing and applications of types of machines and transformers. This course aims to enable to work professionally in the Electrical Engineering Sector.

PREREQUISITE: 17EEES03- Basics Electrical & Electronics Engineering.

COURSE OBJECTIVES

1	To understand the concepts of field energy, co energy, mechanical force and production of torque and EMF.
2	To analyze the performance characteristics of different types of DC Generator.
3	To analyze the performance characteristics of different types of DC motors.
4	To understand different types of Transformers, construction, working principle and their performance.
5	To familiarize with the applications of DC machines and transformer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: learn the concepts and laws of electromagnetic induction in rotating machines	Understand
CO2: study construction, characteristics and applications of DC generators.	Understand
CO3: Explain the construction, characteristics and application of DC Motors	Understand
CO4: Clarify the starter and speed control method of DC Motors	Apply
CO5: Illustrate the construction and working of Single Phase and Three Phase Transformers	Apply
CO6: Analyze the testing of DC Machines & Transformer	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	-	L	-	L	-	L	L	-	S	L	-
CO2	S	M	L	-	L	-	-	L	L	L	L	L	S	M	-
CO3	S	M	L	-	L	-	-	L	-	L	L	L	S	M	-
CO4	M	S	L	L	M	L	-	L	-	L	L	L	S	L	-
CO5	S	L	M	L	-	L	L	L	-	M	-	M	S	L	-
CO6	S	M	M	L	S	-	-	L	L	L	M	L	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC CONCEPTS IN ROTATING MACHINES

Energy in Magnetic Systems-Field Energy and Co Energy-Determination of Mechanical Force- Singly and multiply excited systems -Laws of Electromagnetic induction - Torque and EMF production in rotating machines.

DC GENERATOR

Introduction – electric generator- Constructional features- Principle of operation of DC generator - EMF equation-circuit model - methods of excitation - Losses in DC generator –power stages –condition for maximum efficiency - armature reaction – compensating winding, Commutation - Operating Characteristics of DC generators - Parallel operation of DC generators - Applications of DC generators

DC MOTORS

Principle of operation of DC motors - Back EMF - Torque Equation-Types of DC motors- characteristics of DC motors - Starting of DC motors: review of mechanical starter, electronic soft starters for DC motor with energy saving. Speed control: Field control, Armature control, voltage control– efficiency- Applications.

TRANSFORMERS

Construction - principle of operation - EMF equation - transformer on no load and on load -effects of resistance and leakage reactance of the windings - Ideal transformer – equivalent circuit – phasor diagram – transformer losses - Voltage regulation- All day efficiency- Three phase transformers-connections – Scott Connection - Phasing of transformer- parallel operation of three phase transformers Auto transformer - tap changing transformers

TESTING OF DC MACHINES &TRANSFORMERS

Losses and efficiency –Condition for maximum efficiency - Testing of DC machines: Brake test, Swinburne's test, Retardation test, Hopkinson's test, Testing of transformer: polarity test, load test, Open circuit and short circuit test, Sumpner's test.

TEXT BOOKS:

1. *D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill Publishing Company Ltd, 2010.*
2. Dr.S.K.Bhattacharya, " *Electrical Machines*" Tata McGraw Hill Publishing, New Delhi,1998
3. *Dr. Murugesh Kumar K. "DC Machines and Transformers'', Vikas Publishing House Pvt Ltd., 2010.*

REFERENCE BOOKS:

1. *B. L. Theraja, A. K. Theraja, A Text Book of Electrical Technology, Volume II, S.Chand & Company Ltd, New Delhi, 2007.*
2. R.K. Rajput, Electrical Machines, Laxmi Publications Ltd, New Delhi, 2011.
3. E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, Electric Machinery, Tata McGraw Hill Publishing Company Ltd, New Delhi ,2003.

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17EECC03	ELECTRO MAGNETIC THEORY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To introduce the fundamentals of electromagnetic fields, waves and their applications in Engineering.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To understand the concepts of Electrostatics and their applications
2	To familiarize with the concepts of Magneto statics and their applications
3	To understand Faraday's laws, Maxwell's equations, induced EMF and their applications.
4	To learn the concept of Electromagnetic Fields, waves and wave propagation.
5	To understand the concepts of field modeling and computation.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the behavior of electric and magnetic fields.	Understand
CO2: Illustrate the characteristics and applications of Electric and Magnetic fields	Apply
CO3: Develop Inductance and Capacitance of a given electrical component	Analyze
CO4: Relate Electric and Magnetic fields with help of Faraday's Law, Lenz's law and Maxwell's Equation and their applications to Electrical machines	Apply
CO5: Examine Electromagnetic wave propagation in different media	Analyze
CO6: Compute Field Modeling & Computation	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L			M				L	L	M			L
CO2	M	L	L							M	M	M			L
CO3	S	M	M	L	S	M			L		M		L	M	
CO4	M	M	L			M									
CO5	M	L	L			M					M				
CO6	L	S										M			

S- Strong; M-Medium; L-Low

SYLLABUS

ELECTROSTATICS
Introduction– Sources and effects of electromagnetic fields - Difference between field theory and circuit theory - Charge - Coulomb's law - Continuous charge distribution - Electric field intensity - Electric flux - Gauss's law – Potential - boundary value problems - Laplace and Poisson's equations -Electrostatic energy – Dielectrics - Capacitance.

MAGNETOSTATICS
Current Density - Magnetic field - Magnetic flux - Magnetic flux density - Biot-Savart's law -Ampere's law - Torque – Force - Vector potential - Boundary value problem – Energy Density

ELECROMAGNETIC FIELDS
Faraday's law - Lenz's law - Self inductance - Mutual inductance - Co-efficient of coupling - Dot rule for coupled circuits - Series, Parallel - Inductance of solenoid, Toroid, Maxwell's equations (boundary conditions) - Displacement current - Eddy current.

ELECTROMAGNETIC WAVES
Introduction - Solution of wave equation in free space - Conducting media -Uniform plane wave propagation, phase velocity, Group velocity - Conductors and transmission lines - Pointing vector

FIELD MODELLING AND COMPUTATION
Problem formulation - boundary conditions – solutions - analytical methods - variables separable methods - conformal transformation - method of images - numerical methods - finite difference method - finite element method - charge simulation method

Text Books

1. *John D. Kraus, "Electromagnetics with application" McGraw Hill, 5th edition,2011.*
2. *William Hayt, "Engineering Electromagnetics", McGraw Hill, New York, 7th edition, 2014.*
3. *Kraus and Fleish, Electromagnetics with Applications, McGraw Hill International Editions, Fifth Edition, 2008.*

Reference Books

1. *K. A. Gangadhar, P.M. Ramanathan, Electromagnetic Field Theory, Khanna Publishers, Sixteenth Edition, 2011.*
2. *Matthew. N.O. Sadiku, "Elements of Electromagnetics", Fourth Edition, Oxford University Press, 1st Indian Edition, 2010.*
3. *AshutoshPramanik, "Electromagnetism – Theory and Applications", Prentice-Hall of India Private Limited, New Delhi, 2006.*
4. *Md. Abdus Salam, "Electromagnetic Field Theories for Engineering", Springer Singapore, ISBN: 978-981-4585-65-1, 2014.*

COURSE DESIGNERS

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17EECC04	**MEASUREMENTS AND INSTRUMENTATION**	Category	L	T	P	C
	Total Contact Hours – 45	CC	3	0	0	3
	Prerequisite – Basic Electrical & Electronics Engineering					
	Co-requisite - NIL					

Preamble

This course introduces principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail.

COURSE OBJECTIVES

1	To introduce the fundamentals of electrical and electronic instruments
2	To understand the working principles of the electrical and electronic meters
3	To Understand the working principle of AC, DC bridges.
4	To introduce various data storage and display devices.
5	To introduce various transducers and the data acquisition systems.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Explain the functional elements, characteristics, standards and calibration of measuring instruments.	Apply
CO 2	Describe the working of various electrical and electronic meters	Understand
CO 3	Determine unknown values using bridges.	Understand
CO 4	Describe the operation of storage and display devices.	Understand
C0 5	Explain the working of various transducers, ADC and DAC.	Apply

Mapping with Programme outcomes and Programme Specific Outcomes

CoS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	M	-	M	-	-	S	-	M	-	S	M	M
CO2	M	L	M	M	-	-	-	-	-	-	-	-	M	-	-
CO3	S	M	S	L	-	-	-	S	M	-	-	-	S	M	-
CO4	M	M	L	S	-	-	-	M	-	-	M	M	S	M	-
CO5	S	S	M	M	-	-	-	-	-	-	-	M	S	S	-

SYLLABUS

UNIT - I	**INTRODUCTION** **9**
Functional elements of an instrument - static and dynamic characteristics – errors in measurement - statistical evaluation of measurement data - standard and calibration	
UNIT - II	**ELECTRICAL AND ELECTRONICS INSTRUMENTS** **9**
Principle and types analog and digital ammeters and voltmeters – single and three phase Wattmeters and Energy meter– instrument transformers – instruments for measurement of frequency and phase.	
UNIT - III	**COMPARISON METHODS OF MEASUREMENTS** **9**
D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops – Electrostatic and electromagnetic interference – Grounding techniques.	
UNIT - IV	**STORAGE AND DISPLAY DEVICES** **9**
Magnetic disc and tape recorders – digital plotters and printers – CRT displays – digital CRO – LED, LCD and Dot matrix displays. Data Logger	
UNIT - V	**TRANSDUCERS** **9**
Classification of transducers – selection of transducers – resistive, capacitive and inductive transducers – piezo electric transducers – optical and digital transducers- Elements of data acquisition system – A/D, D/A converters – Smart sensors.	

TEXTBOOK

1. A.K. Sawhney, ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2004.
2. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw Hill, II Edition 2004.
2. A.J. Bouwens, ‘Digital Instrumentation’, Tata McGraw Hill, 1997.
3. D.V.S. Moorthy, ‘Transducers and Instrumentation’, Prentice Hall of India Pvt Ltd, 2007.
4. John P. Bentley, ‘Principles of Measurement Systems’, III Edition, Pearson Education, 2000.

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1	Dr. P.Selvam	Professor	EEE	selvam@vmkvec.edu.in
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17EECC05	**ELECTRICAL MACHINES – II**	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

In a modern world the electric motor especially Alternating current motors and Special applications-oriented motors has played a leading role in the high productivity of modern industry, and it is therefore directly responsible for the high standard of living being enjoyed throughout the industrialized world. Hence the course provides the knowledge about the basic study and performance analyzing techniques of AC machines and Special electrical machines.

PREREQUISITE:17EEES03- Basic of Electrical & Electronics Engineering.

COURSE OBJECTIVES

1	To determine the voltage regulation of an alternator from its working principles
2	To describe the synchronous motor operating principle and analyze the synchronous motor with different excitations.
3	To explain the working principle of single phase and three phase induction motor and determine their applications from their characteristics.
4	To employ the different starting and speed control methods of three phase induction motor.
5	To describe the construction and principle of operation of single phase induction motor and various machines which is involved in special Applications.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Identify the parts and predetermine the performance of synchronous generator by varies types of voltage regulation methods.	Remember
CO2: Explain the principle operation and performance characteristics of synchronous motor.	Understand
CO3: Analyze the characteristics of three phase induction motor through its equivalent circuit and circle diagram.	Analyze
CO4: Apply suitable starting and speed control methods to enhance the performance of three phase induction motors.	Apply
CO5: Evaluate the performance of special machines and can able to choose the suitable starting methods of single phase induction motor.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	S	-	-	-	-	M	L	-
CO2	S	M	-	M	-	-	-	M	-	-	-	-	M	M	-
CO3	S	S	-	M	-	-	-	M	-	-	-	-	M	M	-
CO4	S	M	-	M	-	L	-	M	-	-	-	M	S	M	-
CO5	S	L	M	L	L	L	-	M	-	-	-	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

SYNCHRONOUS GENERATOR

Basic Principle – Details of Construction - Types of Rotor - Equation of Induced EMF - Effect of Harmonics on Pitch and Distribution Factors - Vector Diagrams of Loaded Alternator - Synchronous Reactance - Synchronous Impedance-Armature Reaction - Voltage Regulation - EMF,MMF,ZPF and ASA methods - Synchronizing and Parallel Operation of Alternator – Salient Pole Synchronous machines- Two Reaction Theory - Determination of Xd and Xq using Slip test - Operating Characteristics - Capability Curves.

SYNCHRONOUS MOTOR

Principle of operation - Starting Methods - Torque Equation - Power Flow within a Synchronous Motor– Power Developed by a Synchronous Motor – Equivalent Circuit - Effect of increased Load with Constant Excitation – Effect of Changing Excitation at Constant Load – V curve and inverted V curve – hunting and Methods of Suppression - Synchronous Motor Applications

THREE PHASE INDUCTION MOTOR

Construction and types of rotor - Principle of operation – Starting torque – Running torque - Condition for Maximum Torque - Slip-Torque equation - Slip Torque Characteristics - Equivalent Circuit- Power Flow Diagram - Losses and Efficiency - Load test - No load and Blocked rotor tests - Circle diagram – Cogging and Crawling - Separation of No Load Losses - Double Cage Rotors - Induction Generator - Synchronous Induction Motor- Applications

STARTING AND SPEED CONTROL OF THREE PHASE NDUCTION MOTOR

Need and necessity of starting and starters - types of starters - stator resistance and reactance starters, rotor resistance starter, auto transformer and star-delta starters – Need of speed control – Types - change of voltage - change of number of poles - change of frequency - cascade connection - slip power recovery scheme.

SINGLE PHASE INDUCTION MOTOR AND SPECIAL MACHINES

Construction of Single Phase Induction Motor - Double revolving field theory - Equivalent Circuit - Load Characteristics - Starting Methods of Single Phase Induction Motor - Variable Reluctance Motor - Stepper Motor - Hysteresis Motor - AC Series Motor -Repulsion Motor - Linear Induction Motor - Universal Motor- Permanent Magnet DC and AC motors – Applications

TEXT BOOKS

1. Nagarath.I.J. and Kothari.D.P., “Electric Machines”, T.M.H. Publishing CoLtd., New Delhi, 4th edition 2010.
2. M.G.Say, “Performance and Design of Alternating Current Machines”, 3rd Edition, CBS Publisher.
3. B. L. Theraja, A. K. Theraja, “A Text Book of Electrical Technology”, Volume II, S.Chand & Company Ltd, New Delhi, 2007.
3. Vincent Del Toro, ‘Basic Electric Machines’ Pearson India Education, 2016.

REFERENCES

1. Gupta., “Theory and Performance of Electrical Machines”, Kataria and Sons, 14th edition 2009.
2. A. E. Fitzgerald, Charles Kingsley, Jr.Stephen D. Umans, “Electric Machinery”, Sixth Edition, Tata McGraw Hill Publishing Company Ltd., 2002.
3. Raj put R.K, “Electric Machines”, Lakshmi publication, fifth edition, reprinted at 2011.

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3.	Mr.S.Prakash	Assistant Professor (Gr-II)	EEE/AVIT	sprakash@avit.ac.in

17ECCC05	DIGITAL LOGIC CIRCUITS & DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

One of the most important reasons for the unprecedented growth of Digital Electronics and systems is the advent of integrated circuits(ICs).Developments in the IC technology have made it possible to fabricate complex digital circuits such as microprocessors, memories and FPGAs etc. This course provides various methods and techniques suitable for a variety of digital system design applications.

PREREQUISITE

17EEES03 - Basics of Electrical and Electronics Engineering

COURSE OBJECTIVES

1	To understand the various number systems and their conversions.
2	To learn the Boolean expressions, Boolean postulates and Karnaugh map method to reduce the variables.
3	To impart the design knowledge of various combinational logic circuits and sequential circuits.
4	To understand the basics of hardware descriptive language.
5	To design the RTL for various logic circuits.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the basic principles of digital system, Logic gates and Boolean laws.	Understand
CO2. Simplify Boolean expression using K-Map techniques.	Appl
CO3. Examine various Combinational circuits using logic gates.	Appl
CO4. Illustrate the operation of sequential circuits using Flip flops	Anal
CO5.Analyze various digital circuits using HDL programming.	Anal

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	L	-	-	-
CO2	S	M	M	L	L	-	-	-	-	-	-	L	S	-	-
CO3	S	S	M	M	M	-	-	-	-	-	-	L	-	M	-
CO4	S	S	M	M	M	-	-	-	-	-	-	L	M	M	-
CO5	S	S	M	M	M	-	-	-	-	-	L	L	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Basics of digital system:

About Digital system, Analog versus Digital, Advantages of processing information in digital form, Number System-Binary,Octal,Decimal & Hexadecimal Number Systems & its Conversion, Complement Arithmetic, Signed Binary Numbers, Binary Codes, Binary Storage And Registers.

Boolean Algebra, Logic Gates & Gate –Level Minimization:

Introduction, Boolean Algebra, basic theorem & properties of Boolean Algebra, Boolean functions, canonical & standard forms, logical operations, logic gates, Integrated circuits, Map method-upto four variable K- maps, Product of Sums (POS) & Sum of Products (SOP) simplification, don't care conditions, NAND & NOR implementations, Exclusive-OR Function, Hardware Description Language(HDL).

Combinational logic:

Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder, Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Code Converters, Encoders, Decoders, Multiplexers.

Synchronous Sequential Logic, Register & Counters:

Sequential circuits, storage elements: latches, flip flops, Analysis of clocked sequential circuits, Moore and Mealy circuits ,state diagram, state reduction & Assignment, design procedure, shift registers, ripple counters, synchronous counters.

Design At The Register Transfer Level:

Register Transfer Level Notation, Register Transfer Level In HDL, ASM, Sequential Binary Multiplier, Control Logic, HDL Description Of Binary Multiplier, Design With Multiplexers, Race Free Design, Latch Free Design.

TEXT BOOKS :

1. Morris Mano, "Digital Design (with an introduction to the verilog HDL)", Prentice-Hall of India.
2. John F. Wakerly, "Digital Design Principles & Practices", 4th edition, Prentice-Hall, 2005.

REFERENCE BOOKS:

1. Stephen D. Brown, and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design, 2nd Edition," McGraw Hill, June, 2007.
2. William Kleitz, "Digital Electronics: A Practical Approach with VHDL", Ninth Edition, Pearson, 2002.
3. Floyd T.L., "Digital Fundamentals ", Charles E. Merrill publishing Company, 1982.
4. Tokheim R.L., "Digital Electronics - Principles and Applications ", Tata McGraw Hill, 1999.
5. Jain R.P., "Modern Digital Electronics ", Tata McGraw Hill, 1999

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17EECC06	POWER ELECTRONICS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Power electronics involves the study of various applications of electronic devices for conversion, control and conditioningofelectrical energy. It is an enablingtechnology with a very wide range of applications, such as military/avionic products, industrialproducts, Transportation system, Telecom products, Medical equipments etc.

PREREQUISITE: 17ECCC20-Semiconductor Devices and Circuits.

COURSE OBJECTIVES

1	To get an overview of different types of power semiconductor devices, switching characteristics and protection circuits.
2	To understand the operation, characteristics and performance parameters of controlled and uncontrolled rectifiers.
3	To study the operation, characteristics of voltage and current source inverters and learn the different modulation techniques, harmonic reduction methods.
4	To understand the operation of switching mode regulators, choppers and it’s control.
5	To study the operation of AC to AC converters, Matrix convertersand applications of power electronic circuits.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1:Explain the role of powerelectronics in variousindustrial/commercial/residentialfacilities	Understand
CO2:Explain operation andperformance characteristics ofpower semiconductor devices	Understand
CO3:Predict filters for the given powerconverters	Apply
CO4: Intrepret rectifiers, inverters andDC-DC converters for the givenapplication	Apply
CO5: Analyze effect of harmonics inpower converters	Analyze
CO6:Interpret the performance ofgiven power converter usingPSPICE / MATLABsoftware	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L			M		M								
CO2	S	L									S				
CO3	S	M	M	L	M						S	M	L	S	
CO4	S	M	M	L	M		M				S	M	L	S	
CO5	S	S	M	M		M			S	S	M		M	S	
CO6	S	S	M	M	S	M			S	S	S	S		S	

S- Strong; M-Medium; L-Low

SYLLABUS

POWER ELECTRONICS DEVICES

Overview of switching devices - Principles of operation, Characteristics, Protection and Gate drive circuits of Power Diode & Power Transistor, MOSFET, IGBT, SCR andTRIAC - Design of filters.

AC to DC CONVERTERS

Single Phase and Three Phase uncontrolled Rectifiers - Single Phase and Three Phasecontrolled Rectifiers - performance parameters - Dual converters.

DC to AC CONVERTERS

Single Phase and three Phase Voltage Source Inverters - Current source inverter - PWM Schemes - Frequency and Voltage Control - Harmonic reductions.

DC-DC CONVERTERS

Stepdown and stepup chopper – Time ratio control and current limit control – Switching mode regulators Buck, Boost, Buck-Boost.

AC-AC CONVERTERS& POWER ELECTRONIC APPLICATIONS

AC voltage controllers - single phase and three phase cycloconverter - Matrix converters - UPS - SMPS – HVDC systems - Computer simulation of PE circuits.

TEXT BOOKS:

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice HallIndia, 3rd Edition, New Delhi, 2004.
2. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters,applications and design", John wiley and Sons, 3rd Edition, 2006.

REFERENCE BOOKS:

1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Muhammad H. Rashid, "Power Electronics Circuits, Devices and Applications", Pearson India Education Services Pvt.Ltd, 3rd Edition, ISBN: 978-93-325-1844-5, 2014.

COURSE DESIGNERS

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17EECC07	**TRANSMISSION & DISTRIBUTION**	Category	L	T	P	C
		CC	3	0	0	3

Preamble

It is concerned the function of different components used in Transmission and Distribution levels of power systems and modeling of the components, enrich with the fair knowledge in the recent trends in power Transmission and Distribution Systems.

PREREQUISITE: ELECTRO MAGNETIC THEORY(17EECC03)

COURSE OBJECTIVES

1	To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
2	To obtain the equivalent circuits for the transmission lines based on distance and to determine the voltage regulation and efficiency.
3	To study different types of insulators and constructional features of HT & LT cables.
4	To study the classification and functions of major components of substations.
5	To understand the structure of AC and HVDC Transmission systems and its various operating voltages.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Explain the importance and the functioning of transmission line parameters.	Understand
CO 2	Model the transmission lines and analyse their performance	Analyze
CO 3	Explain the knowledge of line insulators and underground cables.	Understand
CO 4	Describe the components of substation and grounding.	Understand
C0 5	Compare the HVDC and AC systems and analyse the performance of AC distribution systems.	Analyze

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	S	L	M	--	--	--	--	L	S	S	--
CO2	S	M	S	--	S	L	--	--	--	--	--	L	S	S	L
CO3	--	M	M	--	--	L	M	--	--	--	--	M	L	--	L
CO4	--	M	--	--	--	M	--	--	--	--	--	L	--	--	M
CO5	S	M	M	--	--	M	M	--	--	--	--	L	--	--	M

SYLLABUS

TRANSMISSION LINE PARAMETERS

Structure of electrical power system: various levels such as generation, transmission and distribution - Parameters of single and three phase transmission lines with single and double circuits: Resistance, inductance and capacitance of solid, stranded and bundled conductors: Symmetrical and unsymmetrical spacing and transposition - Application of self and mutual GMD - Skin and Proximity effects - Interference with neighboring communication circuits - Typical configuration, conductor types and electrical parameters of 400, 220, 110, 66 and 33 kV lines.

MODELLING AND PERFORMANCE OF TRANSMISSION LINES

Classification of lines: Short line, medium line and long line - equivalent circuits, attenuation constant, phase constant, surge impedance, transmission efficiency and voltage regulation - Sag tension calculation: Factors affecting sag, Support at same level, Effect of ice and wind, Total length of conductor, Equivalent span, Support at different levels - Ferranti effect, Phenomena of corona and its losses.

LINE INSULATORS AND UNDERGROUND

Purpose and requirement of line insulators – material for insulators – pin, suspension, strain, stray and shackle insulators – failure of insulator – testing of insulators – voltage distribution over a string of suspension insulators – string efficiency – equalization of potential across each unit – corona and it's effect (problems in voltage distribution over a string of insulators) Underground cables :- Advantages of cables – classification of cables– belted cable – oil filled cables – advantages and disadvantages of oil filled cables – laying of cables – grading of cables.

SUBSTATION , GROUNDING SYSTEM AND DISTRIBUTION SYSTEM

Classification functions and major components of substations. Bus-bar arrangements – substation bus schemes – single bus, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker- and - a half with two main buses, double bus-bar bypass isolators. Importance of ear thing in a substation. Qualitative treatment to neutral grounding and ear thing practices in substations. Feeders, distributors and service mains. DC distributor – 2 - wire and 3 - wire, radial and ring main distribution. AC distribution - single phase and three phase 4 -wire distribution.

AC TRANSMISSION & HVDC TRANSMISSION

Typical layout of AC power supply scheme – influence of voltage on conductor materials – limits of line voltage – Kelvin's law – It's limitations – OH lines –line supports – various types of supports with their applications – spacing between conductors – length of span – sag calculations for the over head– effect of ice covering and wind over the line – calculations of sag at the time of erection – when the supports are at equal level and at unequal level –skin effect – ferranti effect , High voltage DC transmission – HVDC projects in INDIA and abroad – advantages and disadvantages of HVDC transmission – basics of protection of HVDC system.

TEXTBOOK

1. *B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.*
2. *S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.*
3. *Veerappan.N and Krishnamurthi .S.R,' Power Systems Switch Gear and Protection' ,S.Chand Edition 2009.*
4. *Ravindranath, B and Chander, N, 'Power System Protection and Switchgear', Wiley Eastern Ltd., 1977*

REFERENCES

1. *Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.*
2. *HadiSaadat, 'Power System Analysis,' Tata McGraw Hill Publishing Company', 2003.*
3. *V.K.Mehta,Rohit Mehta,' Principles of power system',S.Chand & Company Ltd, New Delhi,2013.*
4. *Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi.*
5. *Wadhwa, C.L., 'Electrical Power Systems', New Age International (P) Ltd., Publishers, 1995.*
6. *Patra, S.P., Basu , S.K. and Chowduri, S., 'Power systems Protection', Oxford and IBH Publishing Co, 1983.*

COURSE DESIGNERS

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17EECC08	**CONTROL SYSTEMS**	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course shall introduce the analysis and regulation of the output behaviors of dynamical systems subject to input signals. The course focuses primarily on using Laplace and frequency-domain techniques. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems. At the end of this course, one should possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function and use it for obtaining system response, analyze dynamic systems for their stability and performance, and design controllers (such as Proportional-Integral-Derivative) based on stability and performance requirements.

PREREQUISITE

17EEES03 **–** Basics of Electrical and Electronics Engineering

COURSE OBJECTIVES

1	Understand the feedback and feed-forward control; apply block diagram representations of control systems.
2	To find time response of given control system model, various controllers design and simulation using MATLAB.
3	To understand the frequency domain analysis, use of frequency response methods for open loop and closed loop control systems.
4	To analyze the stability of closed and open loop systems using various methods and to design compensators,
5	To develop and analyze the state space models.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Find Transfer function of systems.	Understand
CO2	Find the time response of given control system model and to design a controller.	Create
CO3	Find the frequency response of control system model using frequency response plots.	Analyze
CO4	Analyze the stability of the control system and design the suitable compensators.	Create
CO5	Apply state space techniques to model control systems.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L	S	M	-	-	-	-	-	M	M	S	M	-
CO2	S	M	-	M	S	-	-	M	-	-	-	M	S	M	S
CO3	S	M	-	M	S	-	-	-	-	-	-	M	S	M	-
CO4	S	M	-	M	S	-	M	-	-	-	M	M	S	M	S
CO5	S	M	-	M	S	L	L	-	M	-	M	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CONTROL SYSTEMS

Basic elements in control systems – Open and closed loop systems – Mechanical Translational and Rotational Systems, Electrical analogy – Transfer function – Block diagram reduction techniques – Signal flow graphs.

TIME RESPONSE ANALYSIS

Time response – Time domain specifications – Types of test input – I and II order system response – Error coefficients – Generalized error series – Steady state error – Effects of P, PI, PID modes of feedback control. Design and Simulation of time domain analysis using MATLAB.

FREQUENCY DOMAIN ANALYSIS

Frequency response analysis, ,Frequency domain specifications, Correlation between time and frequency responses, Minimum phase, Non minimum phase and all pass transfer functions, Bode Plot, Polar Plot, Constant M and N circles, Nichols chart, Design and Simulation of frequency domain analysis using MATLAB.

STABILITY ANALYSIS AND COMPENSATOR DESIGN

Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, Introduction to Root-Locus Techniques, Construction of root loci, Nyquist stability criterion. Lag, Lead and Lag-Lead networks, Compensator design using Bode plots & Root Locus.

STATE VARIABLE ANALYSIS, AND APPLICATION OF CONTROL SYSTEMS

Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems. Synchros – AC servomotors- DC Servo motors -Stepper motors- Tacho generator.

TEXT BOOKS

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond. “Basic Control System Technology”, Viva low priced student edition, 1998.
4. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley, 1995 (MATLAB Reference).
5. M. Gopal, “Control Systems: Principles and Design”, 3rd Edition, McGraw, Hill, 2008
6. Nise N.S , “ Control Systems Engineering”, 6th Edition , Wiley India , 2016.

REFERENCES

1.Benjamin C Kuo, “Automatic Control system”, Prentice Hall of India Private Ltd., New Delhi, 2009.
2. R.C. Dorf and R.H. Bishop, “Modern Control Systems”, 12th Edition, Prentice, Hall, 2010.
3. http://www.mathworks.com/access/helpdesk/help/toolbox/control/
4. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.
5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.

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17EECC09	POWER SYSTEM ANALYSIS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To understand the necessity and to become familiar with the modeling of power system and components and to apply different methods to analyse power system for the purpose of system planning and operation.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To model the power system under steady state operating condition.
2	To study the power flow models and apply efficient numerical methods to solve the power flow problem
3	To model and analyse the power systems under abnormal (or) fault conditions.
4	To model & analyse the transient behaviour of power system when it is subjected to a fault.
5	To the study the Importance of stability analysis in power system planning and operation.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Describe the modelling of power system and components.	Understand
CO2: Solve an solution of Load flow problems.	Apply
CO3: Examine the various types of Symmetrical faults.	Analyze
CO4:Examine the various types of Unsymmetrical faults.	Analyze
CO5: Explain the importance of stability analysis in power system planning and operation.	Understand
CO6: Classification of types of stability.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L	--	S	L	--	--	--	--	L	--	S	S	M
CO2	S	S	M	--	S	--	--	--	L	--	S	M	S	S	M
CO3	S	S	S	--	S	M	M	--	M	--	S	--	S	S	M
CO4	S	S	S	--	S	M	S	--	S	--	S	--	S	S	M
CO5	S	S	L	--	S	--	--	--	--	--	S	S	--	M	--
CO6	S	L	L	L	S	--	--	--	--	--	S	M	S	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Modern power system (or) electric energy system - Analysis for system planning and operational studies – basic components of a power system. Generator models Transformer model transmission system model - load representation. Single line Diagram – per phase and per unit representation – change of base. Simple building algorithms for the formation of Y-Bus matrix and Z-Bus matrix.

POWER FLOW ANALYSIS

Importance of power flow analysis in planning and operation of power systems. Statement of power flow problem - classification of buses into P-Q buses, P-V (voltagecontrolled) buses and slack bus. Development of Power flow model in complex variables form and polar variables form. Iterative solution using Gauss-Seidel method including Q-limit check for voltagecontrolled buses – algorithm and flow chart. Iterative solution using Newton-Raphson (N-R) method (polar form) including Q-limit check and bus switching for voltage-controlled buses - Jacobian matrix elements – algorithm and flow chart. Development of Fast Decoupled Power Flow (FDPF) model and iterative solution – algorithm and flowchart; Comparison of the three methods.

FAULT ANALYSIS – BALANCED FAULTS

Importance short circuit (or) for fault analysis - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents.

FAULT ANALYSIS – UNBALANCED FAULTS

Introduction to symmetrical components – sequence impedances – sequence networks – representation of single line to ground, line to line and double line to ground fault conditions. Unbalanced fault analysis - problem formulation – analysis using Z-bus impedance matrix – (algorithm and flow chart.).

STABILITY ANALYSIS

Importance of stability analysis in power system planning and operation – classification of power system stability - angle and voltage stability – simple treatment of angle stability into small-signal and large-signal (transient) stability Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method. Algorithm and flow chart.

TEXT BOOKS

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Publishing Company, New Delhi, 2002.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi, Second Edition, 2003.

REFERENCES

1. P. Kundur, 'Power System Stability and Control, Tata McGraw Hill, Publications,1994.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', McGraw Hill International Book Company, 1994.
3. I.J. Nagrath and D.P. Kothari, 'Modern Power System Analysis', Tata McGraw-Hill Publishing Company, New Delhi, 1990.
4. .K.Nagasarkar and M.S. Sukhija Oxford University Press, 2007

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17ECCC10	LINEAR INTEGRATED CIRCUITS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Linear Integrated circuits enables the students to have an insight knowledge on fundamentals of various integrated circuits. The designed course makes the students to work on the various applications of the Integrated Circuits. This subject helps the students to design, model and develop amplifier circuits, comparators, regulators, filters, timer, D/A and A/D converters and PLL.

PREREQUISITE

17ECCC01 - Semiconductor Devices

COURSE OBJECTIVES

1	To Understand the basics of Integrated Circuits and its fabrication.
2	To get familiarized with operational amplifiers and its Characteristics.
3	To Construct various circuits using operational amplifier and analyze its performance.
4	To design and the working of waveform generators, regulators, filters and timers circuits.
5	To Understand the basic concepts of PLL.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe the Concepts of Fabrication of active and passive components	Understand
CO2. Interpret the Operational Amplifier with its characteristics.	Apply
CO3. Design and analyze the various applications of Operational Amplifier.	Analyze
CO4. Design and analyze wave generators and regulators.	Analyze
CO5. Designing and analyzing filters and Timer circuits.	Analyze
CO6. Analyze the various functional blocks of PLL.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	M	-	-	-
CO2	S	M	M	M	M	-	-	-	-	-	-	M	-	-	-
CO3	S	S	M	M	M	-	-	-	-	-	-	M	S	-	M
CO4	S	S	M	M	M	-	-	-	-	-	-	M	M	-	-
CO5	S	S	M	M	M	-	-	-	-	-	-	M	-	M	-
CO6	S	S	M	M	M	-	-	-	-	-	-	M	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTEGRATED CIRCUIT FABRICATION AND CHARACTERISTICS

Integrated Circuit Technology –Basic Monolithic Integrated Circuits-Epitaxial Growth-Masking and Etching-Diffusion of Impurities-Transistors for monolithic circuits-Monolithic Diodes-Integrated Resistors-Integrated Capacitors and Inductors-Monolithic –Circuit Layout-Additional Isolation Methods-Large Scale and Medium Scale Integration.

OPERATIONAL AMPLIFIER

Basic operational Amplifier – Ideal Operational Amplifier - Operational Amplifier Internal Circuits – Examples of IC Op Amps – FET Operational Amplifiers – DC Characteristics – AC Characteristics – Analysis of Data Sheets of an Op Amp.

OPERATIONAL AMPLIFIER APPLICATIONS

Basic Op Amp Applications – Instrumentation Amplifiers – AC Amplifiers – V to I and I to V Converters – Op Amp Circuits Using Diodes – Sample and Hold Circuits – Log/Antilog Amplifiers – Adder/ Sub tractor – Multiplier and Divider – Differentiator and Integrator – Operational Transconductance Amplifier-Pspice Simulation Tools.

COMPARATORS, REGULATORS, FILTERS AND TIMERS

Comparators – Square, Triangular and Sawtooth wave Generators, Series Op Amp Regulators – IC Voltage Regulators – 723 General Purpose Regulators – RC Active Filters – Active Filters using OTA's, Timer – Description of Functional Diagram – Monostable and Astable Operation – Schmitt Trigger

PLL, D/A AND A/D CONVERTERS

PLL – Basic Principles – Phase Detectors/ Comparators – Voltage Controlled Oscillator – Low Pass Filter – Monolithic PLL – PLL Applications – Basic DAC Techniques – A–D Converters – DAC/ ADC Specifications.

TEXT BOOKS:

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 5th Edition 2018.
2. Jacob Millman,Chirstos C.Halkias,"Integrated Electronics",Tata Mc-GRAW Hill, Edition,3rd Edition, 2010

REFERENCE BOOKS:

1. Robert F Coughlin, Fredrick F.Driscoll," Operational Amplifiers and Linerar Integrated Circuits", Phi Learning,6th Edition,2009.
2. Sergio Franco,"DesignwithOperational Amplifiers and Analog Integrated Circuits", Tata Mc-GRAW Hill ,4th Edition, 2016.

COURSE DESIGNERS

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17ECCC07	MICROCONTROLLERS & ITS APPLICATIONS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Microcontroller is used as the main controller in most of the embedded systems nowadays. Due to the development in VLSI technology, microcontrollers evolve which function similar to microprocessors but they have most of the peripherals built on-chip. This course makes the students to be familiar with the architecture and programming of Microcontrollers. This course also introduces the architecture and hardware features of PIC 16F877 and ARM7 (LPC2148) microcontrollers.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To learn the concepts of microprocessors and knowledge of interfacing devices.
2	To study the Architecture of 8051 microcontroller
3	To develop skill in simple program writing of microcontroller
4	To study the interfacing and applications of microcontroller
5	To study the advanced microcontrollers.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the concept of microprocessor and interfacing devices.	Understand
CO2. Explain the architecture and function of 8051 microcontroller	Apply
CO3. Design and implement programs on 8051 Microcontroller	Analyze
CO4. Design and implement applications using 8051 Microcontroller	Analyze
CO5. Illustrate various applications using advanced Microcontrollers.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	-	M	-	-	-	-	-	-	M	S	-	-
CO2	S	S	S	-	M	-	-	-	-	-	-	M	-	-	-
CO3	S	M	M	-	M	M	-	-	-	-	-	M	-	-	-
CO4	S	S	M	-	M	M	-	-	-	-	-	M	M	M	-
CO5	S	M	S	-	M	M	-	-	-	-	-	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTEL 8086 MICROPROCESSOR & I/O INTERFACING

Introduction to 8086 - Architecture of 8086 - Register organization – Signal Description of 8086 - Addressing modes – Data Transfer Instruction – Arithmetic Instruction - Branching Instruction - Program Transfer Instruction – simple programs- Programmable Peripheral Interface 8255 – Programmable Communication Interface 8251 USART – Programmable Interrupt Controller 8259A – Direct Memory Access Controller 8257- Programmable Interval Timer 8253 – Keyboard/Display Controller 8279.

INTEL 8051 MICROCONTROLLER

Introduction to 8 bit microcontroller – architecture of 8051- Signal descriptions of 8051- Role of PC and DPTR- Flags and PSW- CPU registers- Internal RAM & ROM- Special Function Register-Counter & Timers- Serial Communication.

ASSEMBLY LANGUAGE PROGRAM OF INTEL 8051

Interrupt- Addressing Mode- Data Transfer Instruction- Arithmetic Instruction- Logical Instruction- Jump Loop & Call Instruction- I/O Port Programming.

INTERFACING AND APPLICATION OF INTEL 8051

LCD Interfacing - A/D and D/A Interfacing- Sensor Interfacing- Relays and Optoisolators- Stepper Motor Interfacing- DC Motor Interfacing.

ADVANCED MICROCONTROLLERS

PIC 16F877 microcontroller – Architecture On chip ADC, I^2C – SPI – Watchdog timer – ARM7 (LPC2148) microcontroller – Architecture and applications.

TEXTBOOKS:

1. *Muhammad Ali Mazidi and Janica Gilli Mazidi, The 8051 microcontroller and embedded systems, Pearson Education, 5th Indian reprint, 2003.*
2. *Frank D. Petruzella. "Programmable Logic Controllers", McGraw–Hill Book, Company, 1989*

REFERENCE BOOKS:

1. *B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, First edition, New Delhi, 1997.*
2. *Embedded Controller Hand book, Intel Corporation, USA.*
3. *Microcontroller Hand Book, INTEL, 1984.*
4. *Ajay V.Deshmukh, "Microcontrollers- Theory and applications", Tata McGraw-Hill, publisher,2005.*

COURSE DESIGNERS

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17EECC10	POWER SYSTEM OPERATION AND CONTROL	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To become familiar with the preparatory work necessary for meeting the next day's power system operation and the various control actions to be implemented on the system to meet the minute-to-minute variation of system load.

PREREQUISITE :17EECC09- POWER SYSTEM ANALYSIS

COURSE OBJECTIVES

1	Have an overview of system load variation, reserve requirements, operation and control of power system.
2	Give an insight into the role of speed governing mechanism in load frequency control, concept of control area, modeling and analysis of load frequency control loop.
3	Give knowledge of excitation systems and the methods of voltage control.
4	Study the economic dispatch of generated power.
5	Provide adequate knowledge of the functions of energy control center, SCADA system and the security control.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Define the load curves and load duration curve.	Understand
CO2:Apply real power control, reactive power control to different cases	Apply
CO3: Explain the techniques to control power flows, frequency and voltage.	Understand
CO4: Solve Economic dispatch, Unit commitment problems at different loads using conventional and modern methods.	Apply
CO5: Define computer control of power system	Understand
CO6: Design the controllers to maintain power system reliability	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	--	--	S	--	--	--	--	--	--	--	S	M	M
CO2	--	S	S	--	--	--	--	--	--	--	--	--	S	S	M
CO3	--	--	--	M	M	--	--	--	--	--	-	--	S	M	M
CO4	S	S	S	-	S	--	--	--	--	--	--	--	S	S	M
CO5	--	--	--	--	S	--	--	--	--	S	--	--	--	S	S
CO6	--	--	--	M	M	--	--	--	--	--	--	--	S	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

System load – variation - load characteristics - load curves and load-duration curve (daily, weekly and annual) - load factor - diversity factor. Importance of load forecasting and simple techniques of forecasting. An overview of power system operation and control and the role of computers in the implementation. (Qualitative treatment with block diagram).

REAL POWER - FREQUENCY CONTROL

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel. Control area concept LFC control of a single-area system. Static and dynamic analysis of uncontrolled and controlled cases. Integration of economic dispatch control with LFC. Two-area system – modeling – static analysis of uncontrolled case - tie line with frequency bias control of two-area system - state variable model.

REACTIVE POWER–VOLTAGE CONTROL

Basics of reactive power control. Excitation systems – modeling. Static and dynamic analysis - stability compensation - generation and absorption of reactive power. Relation between voltage, power and reactive power at a node - method of voltage control – tapchanging transformer. System level control using generator voltage magnitude setting, tap setting of OLTC transformer and MVAR injection of switched capacitors to maintain acceptable voltage profile and to minimize transmission loss.

COMMITMENT AND ECONOMIC DISPATCH

Statement of economic dispatch problem – cost of generation – incremental cost curve - co-ordination equations without loss and with loss, solution by direct method and λ- iteration method. (No derivation of loss coefficients).Statement of Unit Commitment problem – constraints; spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints. Solution methods - Priority-list methods – forward dynamic programming approach. Numerical problems only in priority-list method using full-load average production cost.

COMPUTER CONTROL OF POWER SYSTEMS

Need of computer control of power systems. Concept of energy control centre (or) load dispatch centre and the functions - system monitoring - data acquisition and control. System hardware configuration – SCADA and EMS functions. Network topology – state estimation - security analysis and control. Various operating states (Normal, alert, emergency, in-extremis and restorative). State transition diagram showing various state transitions and control strategies.

TEXT BOOKS

1. Allen. J. Wood and Bruce F. Wollenberg, ‘Power Generation, Operation and Control’, John Wiley & Sons, Inc., 2003.
2. Chakrabarti&Halder, “Power System Analysis: Operation and Control”, Prentice Hall of India, 2004 Edition.

REFERENCE BOOKS

1. D.P. Kothari and I.J. Nagrath, ‘Modern Power System Analysis’, Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. (For Chapters 1, 2 & 3)
2. L.L. Grigsby, ‘The Electric Power Engineering, Hand Book’, CRC Press & IEEE Press, 2001.
3. HadiSaadat, “Power System Analysis”, (For the chapters 1, 2, 3 and 4)11th Reprint 2007.
4. P.Kundur, ‘Power System Stability and Control’ MC Craw Hill Publisher, USA, 1994.
5. Olle.I.Elgerd, ‘Electric Energy Systems theory an introduction’ Tata McGraw Hill Publishing Company Ltd. New Delhi, Second Edition 2003.

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17EECC11	SOLID STATE DRIVES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE:

Solid State Drives, both ac and dc types are standardized versions for general-purpose applications. Others are intended for specific tasks. In any case, motors should be selected to satisfy the dynamic requirements of the machines on which they are applied without exceeding rated motor temperature. Thus, the first and most important step in motor selection is determining load characteristics, torque and speed versus time.

PREREQUISITE :17EECC06- Power Electronics

COURSE OBJECTIVES

1	Describe the basics and advantages of electric drives.
2	Illustrate single phase and three phase controlled rectifier based dc drive.
3	Interpret various dc to dc converter topology based dc drive.
4	Describe the operation of VSI and CSI drive in induction motor drives.
5	Explain the working of stepper motor, SRM and BLDC motor drive System.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the basics and advantages of electric drives	Understand
CO2: Illustrate single phase and three phase controlled rectifier based dc drive	Apply
CO3: Interpret various dc to dc converter topology based dc drive	Apply
CO4: Explain the operation of VSI and CSI drive in induction motor drives	Understand
CO5: Describe the working of stepper motor, SRM and BLDC motor drive system	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L													
CO2	S	M	L	M			S		L		S	M			L
CO3	S	M	L	M			S		L		M	M		L	M
CO4	M	L									S			L	M
CO5	M	L					S		L		M			S	M

S- Strong; M-Medium; L-Low

SYLLABUS

Electric Drives

Advantage of solid state electric drives - Parts and choice of electrical drives – Status of DC and AC drives - Torque-speed characteristics of motor and load - Selection of Motor power rating - Thermal model of motor for heating and cooling - Classes of duty cycle - Determination of motor rating - Control of Electric drives - Modes of operation - Speed control and drive classifications - Closed loop control of drives.

DC Motor Drives

DC motor and their performance - Speed control - Braking Controlled rectifier fed DC drives - Chopper controlled DC drives.

Induction Motor Drives

Speed control – Stator control-Inverter fed induction motor drives - Rotor resistance control and slip power recovery schemes - Static control of rotor resistance - Vector control of induction motor- Speed Estimation methods – Slip calculation – Direct Synthesis from state equations – Direct Vector control without Speed signal.

Synchronous Motor Drives

Speed control - Inverter fed synchronous motors – Vector control of Synchronous motor – Sensorless control – Trapezoidal SPM machine – Sinusoidal PM Machine.

BLDC Motor and SRM Drives

Operation and control of BLDC motor, Stepper motor and switched reluctance motor drives.

Text Book

1. G. K. Dubey: Fundamental of Electrical Drives - Narosa Publishing House, Chennai, 2004.

Reference Books

1. Bimal K.Bose – Modern Power Electronics and AC Drives – Pearson Education Asia Publication, 2003.
2. R.Krishnan - Electric motor drives – Modeling, analysis and control, Pearson Education, New Delhi, 2003.
3. Muhammad H.Rashid, Power Electronics Circuits, Devices & Applications - Pearson Education India Publication, New Delhi, II Edition, 2007.
4. Ned Mohan, Tore Undeland & William Robbins, Power Electronics : converters Applications and Design- John Willey and sons 2003.
5. Gnanavadivel, "Solid State Drives", Anuradha Publications, Chennai, ISBN-10: 8184721528, Chennai, 2010.

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17EECC12	PROTECTION & SWITCHGEAR	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBL

To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also, to study propagation, reflection and refraction of these surges on the equipment their impact on the power system grid.

PREREQUISITE:

17EECC05-Electrical Machines-II

COURSE OBJECTIVES

1	To study the basic principles, construction and operation of various protection relays.
2	To understand the protection schemes of various electrical equipment and application of CTS and PTS.
3	To study the theory of arc phenomena and arc interruption.
4	To understand construction, operation and capacitive merits of various types of circuit breakers.
5	To study protection schemes against over voltages.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Describe the operating principles of various relays and their construction	Understand
CO2: Compare the various protection systems for power system apparatus.	Analyze
CO3: Classify the various types of circuit breakers and their working	Evaluation
CO4: Construct the Protective methods of Power system against over voltages.	Create
CO5: Design the basic idea about integrated protection.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	S	L	-	M	-	M	S	-	-	-	L	M	-
CO2	M	M	M		-	M	L	M	S	-	-	-	L	M	-
CO3	M	M	S	M	-	M	M	M	S	-	-	-	L	M	-
CO4	M	S	S	L	-	M	L	M	S	-	-	-	M	M	-
CO5	M	L	-	L	-	-	-		S	-	-	-	M	M	-

S- Strong; M-Medium; L-Low

RELAYS -PRINCIPLES &OPERATION

Need for protection – relay terminology – definitions – zones of protection - essential qualities of protective relays. Over current relays directional, distance and differential, under frequency, negative sequence relays - static relays – microprocessor-based relays.

APPARATUS PROTECTION

Apparatus Protection - generator and Transformer Protection, Protection of bus bars, transmission lines, CT's & PT's and their application in protective schemes.

THEORY ARC QUENCHING

Theory of arcing and arc quenching – RRRV – Current Chopping and Capacitive Current breaking – D.C. circuit breaking.

CIRCUIT BREAKERS

Switchgear – fault clearing and interruption of current - various types of circuit breakers - selection of circuit breakers - testing of circuit breakers- intelligent circuit breakers

PROTECTION AGAINST OVERVOLTAGES

Protection against over voltages due to lightning and switching - arcing grounds - Peterson coil - ground wires - surge absorber and diverters Power system earthing – neutral earthing - basic ideas of insulation coordination

TOTAL HOURS : 45

TEXT BOOKS

1. Veerappan.N and Krishnamurthi .S.R,' Power Systems Switch Gear and Protection' , S.Chand Edition 2009.
2. Ravindranath, B and Chander, N, 'Power System Protection and Switchgear', Wiley Eastern Ltd., 1977.
3. Chakrabarti .A, Soni .M.L, Gupta .P.V, 'A text book on power system Engineering', Dhanpat rai & Co. pvt. Ltd., 1998.
4. Badri Ram, Vishwakarma, "Power System Protection and Switchgear", 2nd Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCE BOOKS

1. Wadhwa, C.L., 'Electrical Power Systems', New Age International (P) Ltd., Publishers, 1995.
2. Patra, S.P., Basu , S.K. and Chowduri, S., 'Power systems Protection', Oxford and IBH Publishing Co, 1983.
3. *Sunil.S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 1986*
4. Y.G. Paithankar and S.R. Bhide, "Fundamentals of Power System Protection", 2nd Edition, Prentice Hall of India, New Delhi, 2010.

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17ECCC22	EMBEDDED SYSTEM	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

We can easily find embedded systems everywhere in our daily lives. The numbers of embedded systems are rapidly growing especially in wireless and web applications. The embedded systems market is one of the fastest growing areas in the world. By name, an embedded system is a special-purpose computing device designed to perform dedicated functions. Some of the embedded systems with real-time constraints are called real-time embedded systems. An embedded system consists of its hardware and software.

PREREQUISITE -

COURSE OBJECTIVES

1	To Understand the about designing of an embedded system for commercial applications.
2	To the features, architecture and programming of PIC and ARM microcontrollers
3	To apply the interfacing peripherals with microcontrollers.
4	To design the communication protocols in a Microcomputer system.
5	To apply and develop the fundamentals of real-time operating system in an embedded system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe the working of the Programmable Logic Controllers operations	Apply
CO2. Develop the programming in ladder diagram design	Apply
CO3. Generate a interface peripherals with microcontrollers.	Apply
CO4. Generate the communication protocols in application specific.	Analyze
CO5. Develop a design embedded system in real time.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	L	-	-	-	-	-	-	-	-	-	M	S	M	-
CO4	S	S	L	-	-	-	-	-	-	-	-	M	-	M	-
CO5	S	S	S	M	S	M	S	L	S	S	M	M	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Embedded : Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded System on-chip (Soc) and Use of VLSI Circuit Design Technology, Complex Systems Design and Processors, Design Process in Embedded Systems, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems.

PIC Microcontroller : PIC 16F877 MCU, Architecture, Features, Memory and memory map, I/O ports, Timers and CCP Devices, ADC, Interrupts, Instruction format, Addressing Modes, Instruction Set, Programming with MPLAB IDE.

ARM Based Microcontrollers : Introduction to 16 bit Processors, ARM Architecture, ARM cortex M3, 16 bit ARM Instruction set, Thumb Instruction set, Exception Handling in ARM, Porting Linux in ARM, Assembly and C programming.

Interfacing I/O Devices and Communication Protocols : LED, liquid crystal display, Motor (DC, Servo, Stepper), Relays, Keypad, Keyboard, Touch screen, Sensors (thermocouple, force, displacement), SD card, Infrared connectivity, Serial communication protocols (UART, I2C, SPI, CAN, USB, LIN), Parallel communication protocols (PCI, ISA), Wireless communication networks (Bluetooth, Xbee, Wifi, GSM), Global positioning system receivers, Embedded Systems and the internet.

Multitasking and the Real Time Operating System: The challenges of multitasking and real-time, Achieving multitasking with sequential programming, RTOS, Scheduling and the scheduler, Developing tasks, Data and resource protection- the semaphore, Examples using Salvo Real-time operating systems.

TEXTBOOKS:

1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Second Edition, Tata McGraw-Hill Publications, 2008.

2. Yifeng Zhu,“Embedded Systems with ARM Cortex-M3 Microcontrollers in Assembly Language and C**”,** E-Man Press LLC; 1st edition, 2014.

REFERENCE BOOKS:

1. Tim Wilmshurst, "Designing Embedded Systems with PIC microcontrollers-Principles and Applications", Newnes Publications, 2007.

2. Julio Sanchez Maria P.Canton, “Microcontroller Programming: The microchip PIC”, CRC Press, Taylor & Francis Group, 2007.

3. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006.

4. Muhammad Ali Mazidi, Rolin McKinlay, Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Prentice Hall publications, 2007.

COURSE DESIGNERS

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17EECC13	HIGH VOLTAGE ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course provides to get a fair knowledge about the generation of high voltages and currents. An understanding of high voltage phenomena, and to present the basics of high voltage insulation design and techniques. The course comprehends the concept of solid, liquid and gaseous dielectrics. The itineraries produce the method on generation and measurement of high voltages and currents. It gains knowledge in testing of high voltage equipments and the basics of high voltage laboratory techniques.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understanding of high voltage technology and its applications, Insulation design in general and protection of OH lines
2	To Understand breakdown mechanisms in solids, liquids and gases
3	Analyze transient over voltages and design protection .
4	To analyze the stability of closed and open loop systems using various methods and to design compensators,
5	To Apply diagnostic tests to examine the quality of insulation and apply statistic approach to analyze testing data

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Identify the causes and effects of over voltages and protection of power system against over voltages.	Understand
CO2	Classify the different breakdown mechanisms in Gases, liquids and solids.	Analyze
CO3	Describe the principle of generation of high DC, AC and impulse voltages.	Understand
CO4	Explain the various measurement techniques of high voltages and high currents.	Analyze
CO5	Scrutinize the Measurement of High AC , DC and Impulse Voltages and Currents	Analyze
CO6	Testing of high voltage electrical power apparatus	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	M		S	S		L	L	M	L	M	S	S
CO2	M	S	M	M	L		M	L			S	M	S	L	L
CO3	L	L	S			L			M				M	L	
CO4	L							M		L	L	M			
CO5	S		M		L			M			M	M			M
CO6	S	L	L	L	S	L	L	S	M	M	S	S	M	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS AND INSULATION COORDINATION

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages -System faults and other abnormal conditions-Principles of insulation co-ordination.

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 – Breakdown mechanisms in solid and composite dielectrics.

GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS

Generation of High DC, AC, impulse voltages and currents – Tripping and control of impulse generators.

MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

Measurement of High voltages and High currents – Digital techniques in high voltage measurement.

HIGH VOLTAGE TESTING OF ELECTRICAL POWER APPARATUS

Testing of Insulator - Bushings - Isolators, Circuit breakers – Cables – Transformers –Surge Arresters – Tan Delta measurement – Partial Discharge measurement – Radio interference measurement – International and Indian Standards.

TEXT BOOKS

1. M. S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill,1995.

2. Kuffel,E and Zaengl, W.S, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford , Londan,1986

3. High voltage engineering, Farouk A M Rizk; Giao N Trinh, CRC Press, [2014] ©20 ©2014

REFERENCES

1. E. Kuffel, W. S. Zaengl and J.Kuffel, "High Voltage Engineering Fundamentals", 2nd Edition, Butterworth – Heinmann Publisher, 2000.
2. L. L. Alston, 'High Voltage Technology', 1st Edition, Oxford University Press, 1968.
3. T.J.Gallagher and A.J Pearmain, "High Voltage Measurement, Testing and Design", 2nd Edition, Wiley, New York, 2007.
4. C.L Wadwa, "High Voltage Engineering", 3rd Edition, New Age International, New Delhi, 2012.
5. R.D. Begamudre, "High Voltage Engineering (Problems and Solution)", 1st Edition, New Age International, New Delhi, 2010.

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17EECC14	**ELECTRICAL MACHINES AND DRIVES**	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

In a modern world the electric drives are essential for all the applications especially in mechanical engineering the Electrical drives represent a dominant source of mechanical power in various applications in production, material handling, and process industries etc. hence the course provides the magnificent knowledge about basic concepts, performance analysis of conventional and solid state control of electric drives which can help the mechanical engineer to understand and implement the concepts to various applications in engineering sector.

Prerequisite

17EEES03 - Basics of Electrical & Electronics Engineering A. Basic Electrical Engineering

Course Objectives

1. To select appropriate electrical drive system based on their thermal factors.
2. To interpret the characteristics of DC motors and perform appropriate conventional control techniques for desired applications.
3. To interpret the characteristics of AC motors and perform appropriate conventional control techniques for desired applications.
4. To employ the solid state speed control techniques for DC drives for efficient control.
5. To employ solid state speed control techniques for AC drives for proficient and loss less control.

Course Outcomes

On the successful completion of the course, students will be able to

CO1. Define the concepts of an electrical drive system and choose a suitable motor drive for different applications.	Remember
CO2. Explain the working principle with their characteristics and Predetermine the performance of DC drives with various load and unload conditions.	Understand
CO3.Interpret the conventional speed control methods of DC motors with starting, braking Methods.	Apply
CO4.Identify the parts of AC motors, Predetermine the performance of AC motors with their characteristics and Interpret the conventional speed control methods of AC motors with starting and braking methods.	Analyse
CO5. Evaluate the proficient control of AC and DC drives by utilize the power electronics concepts.	Evaluate

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO24.	S	M	--	--	L								M	M	S
CO25.	S	S	M	--	--								M	M	--
CO26.	M	L	M	S	--								M	M	M
CO27.	S	S	--	M	--								M	M	M
CO28.	S	M	S	M	M						M	M	S	M	M

S- Strong; M-Medium; L-Low

Syllabus

Introduction
Electrical Drives - Basic Elements of a drive system – Types of Electrical Drives –Multi quadrant operation of Electric Drive -Classes of duty – Selection of power rating for drive motors -Factors influencing the choice of electrical drives – Heating and cooling curves – Applications .
DC Drives
Constructional details of DC Motor – Principle of operation DC Motor – Back EMF and torque equations – Types of DC Motors – Characteristics of DC Motors – Starting of DC Motors – Types of Braking – Conventional Speed Control of DC Motors: Armature Voltage Control, Field Flux Control, Ward Leonard Control. Stepper motor: Permanent magnet stepper motor – Principle of operation – Applications.
AC Drives
Construction and operational details of Single and Three Phase Induction Motors – Types – Slip – Torque Equations – Speed-Torque Characteristics – Types of Starters – Types of Braking – Conventional Speed Control of Induction Motors – Construction and operational details of synchronous motor – Starting methods- types of Excitation -V curve and inverted V curve-Servomotor- Applications.
Solid State Drives and Speed Control of DC Drives
Introduction of Solid state Drives- Functional block diagram and advantages of Solid state Drives – Converter – Phase control- Single Phase and Three Phase Fully controlled Converter: Principle of operation and waveforms of single phase and three phase fully controlled converter fed DC drive – Chopper - Control strategies- Choppers Fed DC Motor Drive – Applications.
Solid State Speed Control of AC Drives
Inverter, AC voltage controller and Cycloconverter - Voltage Source Inverter and Current Source Inverter – VSI fed Three Phase Induction Motors – CSI Fed Three Phase Induction Motors- Cycloconverter Fed Induction Motor Control - Voltage/Frequency Control of induction motor, Static Rotor Resistance Control – Static Scherbius and static Kramer Drives block diagram and explanation – Applications.
TEXTBOOKS
1 Gopal.K.Dubey,"Fundamentals of Electrical Drives" Narosa Publishing House, 2001 2 Theraja,B.L and Theraja, A.K., "A text book of Electrical Technology – Volume II (AC & DC Machines)" S.Chand & Company Ltd., New Delhi, 2016.
REFERENCES
1 VedamSubrahmanyam, "Electric Drives Concepts and Applications" Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998. 2 M.D.Singh and K.B. Khanchandani, "Power Electronics", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2008

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17EECC15	ELECTRICAL TECHNOLOGY	Category	L	T	P	Credit
		FC	3	0	0	3

PREAMBLE

This course is concerned with the constructions, characteristics and applications of various electrical machines and transformer.

PREREQUISITE

17EEES03- Basic of Electrical & Electronics Engineering

COURSE OBJECTIVES

1	To gain knowledge about the working principle, construction, applications of DC machines
2	To familiarize construction, operation, testing of transformers.
3	To gain knowledge about the construction, operation and applications of DC machines
4	To gain knowledge about construction, principle of operation and performance of induction machines.
5	To understand the construction, operation of special machines.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Explain the construction, characteristics and applications of DC machines	Understand
CO2	Analyze the performance of different types of DC machines	Analyze
CO3	Explain the fundamentals and operation of Transformer	Understand
CO4	Analyze the performance of different types of Transformer	Analyze
CO5	Explain the construction, operation of AC machines and special machines	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	-	L	-	-	-	M	M	L	S	M	-
CO2	M	S	-	L	L	-	-	L	L	-	S	-	S	M	-
CO3	M	M	M	S	-	-	-	-	-	L	-	L	S	M	-
CO4	S	S	-	M	M	M	L	L	L	-	S	-	S	M	-
CO5	S	M	M	M	-	-	-	-	-	L	-	L	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

D.C GENERATORS AND DC MOTORS
Principle of operation of DC Machines- EMF equation – Types of generators – Magnetization and load characteristics of DC generators, DC Motors – Types of DC Motors – Characteristics of DC motors – 3-point starters for DC shunt motor – Losses and efficiency – Swinburne's test – Speed control of DC shunt motor – Flux and Armature voltage control methods.

TRANSFORMERS
Principle of operation of single phase transformer – types – Constructional features – Phasor diagram on No Load and Load – Equivalent circuit, Losses and Efficiency of transformer and Regulation – OC and SC tests – Predetermination of efficiency and regulation.

THREE PHASE INDUCTION MOTOR
Principle of operation of three-phase induction motors – Slip ring and Squirrel cage motors – Slip-Torque characteristics – Efficiency calculation – Starting methods.

ALTERNATORS
Alternators – Constructional features – Principle of operation – Types - EMF Equation – Distribution and Coil span factors – Predetermination of regulation by Synchronous Impedance Method – OC and SC tests.

SPECIAL MOTORS
Principle of operation - Synchros-Synchronous reluctance motor -Stepper Motors - Switched reluctance motor-AC servomotor-AC tachometers- Shaded pole motors-Capacitor motors -Characteristics

TEXT BOOKS

1. "Introduction to Electrical Engineering "– M.S Naidu and S. Kamakshaiah, TMH Publ.1995
2." Basic Electrical Engineering" - T.K. Nagasarkar and M. S. Sukhija, Oxford University Press, 2005
3. " Electrical Machines" Er. R.K. Rajput , Laxmi Publications, 5^{th} Edition 2016

REFERENCES

1. "Theory and Problems of basic electrical engineering" - I.J. Nagarath and D.P Kothari, PHI Publications 2016
2. "Principles of Electrical Engineering "- V.K Mehta, S. Chand Publications.2008

COURSE DESIGNERS

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1	D. Saranya	Assistant Professor (Gr-II)	EEE/AVIT	dsaranya@avit.ac.in
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17EECC16	POWER ELECTRONICS AND DRIVES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Power electronics deals with the processing and control of ‘raw’ electrical power from an electrical source such as an AC mains supply, a battery bank, a photovoltaic array, or a wind turbine into a form and quality suitable for a particular electrical load. It is an enabling technology with a very wide range of applications, such as a cell phone charger, a personal computer, a microwave oven, an MRI system, a hybrid electric car, or even the electrical grid. As can be noted, the power levels handled can vary from a few watts to several hundreds of megawatts. In this course, we will study the basic principles behind the power electronic circuits used in most such power processing applications. These circuits include power converters for DC to DC, DC to AC and AC to DC applications.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To get an overview of different types of power semiconductor devices and their switching characteristics.
2	To understand the operation, characteristics and performance parameters of controlled rectifiers.
3	To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4	To learn the different modulation techniques inverters and to understand harmonic reduction methods.
5	To study the operation of AC voltage controller.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: The basic semiconductor physics to the properties of real power semiconductor devices and differentiate from low power devices.	Remember
CO2: The concepts of operation of AC-DC converters in steady state and transient state of both continuous and discontinuous modes.	Understand
CO3: Classify and design choppers for simple electrical application	Apply
CO4: Identify the proper gating sequence and control circuit in operating the single phase and three phase inverter circuits.	Analyze
CO5: Analyze the performance parameter, various techniques for analysis and design of AC voltage controller and also list the various control schemes in cycloconverter.	Analyze
CO6: Describe the concepts of electric machines.	Understand
CO7: Implement the power electronics concepts to AC & DC drives to made the effective control	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**S**	**M**	**M**	**M**	**L**	L	-	L	L	L	L	L	L	S	-
CO2	**S**	**S**	**M**	**M**	**L**	-	M	-	-	-	-	-	L	S	-
CO3	**S**	**S**		**M**	**L**	M	M-	-	-	-	-	-	L	S	-
CO4	**S**	**S**	**S**	**M**	**S**	-	M	-	-	-	-	-	L	M	-
CO5	**M**	**S**	**-**	**M**	**S**	-	M	-	-	-	-	-	M	M	-
CO6	**M**	**S**	**M**	**S**	-	-	M	-	-	-	-	-	M	M	-
CO7	**M**	**M**	**M**	**S**	**M**	M	-	-	-	-	-	-	M	M	-

S- Strong; M-Medium; L-Low-

POWER SEMI-CONDUCTOR DEVICES
Overview of switching devices – Driver and snubber circuit of SCR TRIAC, GTO, IGBT, MOSFET – Computer simulation of PE circuits.

RECTIFIERS & CHOPPERS
Introduction-2 pulse / 3 pulse and 6 pulse converters – Dual converters. Basic Principles of Choppers - Stepdown and stepup chopper – Time ratio control and current limit control – Buck, Boost, Buck-Boost converters.

INVERTERS & AC - AC CONVERTERS
Single phase and three phase [120^o & 180^o mode] inverters – PWM techniques – Sinusoidal PWM, Modified sinusoidal PWM and multiple PWM. Single phase AC voltage controllers – Multistage sequence control – single phase and three phase cycloconverter.

ELECTRICAL DRIVES
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY)
Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

Total Hours : 45

TEXT BOOKS:
1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, 3rd Edition, New Delhi, 2004.
2. G.K. Dubey “Fundamental Electrical Drives” second edition 2002, Narosa Publications, Second edition, 2002.

REFERENCES:
1. Cyril.W.Lander, "Power Electronics", McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbra "Power Electronics", Khanna Publishers, third Edition 2003.
3. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004Edition.
4. N.K.De.,P.K.Sen “Electric Drives”, Prentice Hall, First edition 1999.
5. Pillai, S.K., “ A First course on Electrical Drives”, Wiley Eastern Ltd., New Delhi, 1982

COURSE DESIGNERS

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17EECC19	**ROBOTICS AND AUTOMATION (THEORY & PRACTICE)**	**Category**	**L**	**T**	**P**	**Credit**
		CC	**2**	**0**	**2**	**3**

PREAMBLE

Robotics is the applied science of motion control for multi-axis manipulators and is a large subset of the field of "Mechatronics" (Mechanical, Electronic and Software engineering for product or systems development, particularly for motion control applications). Robotics, sensors, actuators and controller technologies are continuously improving and evolving synergistically. This course supports the students to design and develop multi-DOF manipulator and wheeled mobile robot.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To Understand the actuators used in robotic manipulators and indicate their advantages and limitations.
2	To apply the forward kinematic model of multi-degree of freedom to develop a robot arm and wheeled
3	To apply a static force and dynamic model of two degrees of freedom to develop robot arm
4	To introduce different types of robotics and demonstrate them to identify different parts and components
5	To practice with the simulation from simple to six axis robot.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe the working of the subsystems of robotic manipulator and wheeled mobile robot	Understand
CO2. Demonstrate the forward kinematic model of multi-degree of freedom (DOF) manipulator and inverse kinematic model of two and three degrees of freedom planar robot arm and wheeled robot	Apply
CO3. Exhibit the static force and dynamic model of two degrees of freedom planar robot arm	Apply
CO4. Implement the programming and control of robots	Apply
CO5. Predict the Path and trajectory planning for given environment	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	-	M	-	-	M	S	M	-
CO2	S	M	M	-	-	-	-	-	M	-	-	M	S	M	-
CO3	S	M	M	-	-	-	-	-	M	-	-	M	S	M	-
CO4	S	M	M	M	L	-	-	-	M	-	L	L	S	M	M
CO5	S	S	S	M	M	M	-	-	M	-	M	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Robotics. Mechanical structure: Robot Configuration - Robot Anatomy, Sub-systems/ Elements of Industrial Robot - Performance characteristics of industrial Robots. Mobile robot locomotion: Introduction, key issues for locomotion, wheeled locomotion-wheel design, geometry, stability, manoeuvrability and controllability. Applications - Progressive advancement in Robots – Point to point and continuous motion applications - Mobile manipulators and its applications.

Kinematic model: Forward Kinematics for two DOF manipulator – Algebraic method, Mechanical structure and notations, Coordinate frames, Description of objects in space, Transformation of vectors, Fundamental rotation matrices (principal axes and fixed angle rotation) Description of links and joints, Denavit-Hartenberg (DH) notation, Forward Kinematics for multi-Degrees of Freedom (DOF) manipulator. Inverse kinematics of two DOF planar manipulator - Manipulator workspace. Mobile Robot kinematics: kinematic model and constraints, Mobile robot workspace-motion control.

Static model: Differential relationship - Velocity analysis – Jacobian matrix – Determination of forces and equivalent torques for joints of two link planar robot arm. Dynamic model: Euler –Lagrangian formulation - Forward and inverse dynamic model for two DOF planar manipulator.

PRACTICE :
Different types of robots based on configuration and application, Different type of links and joints used in robots, components of robots with drive system and end effectors.

SIMULATION BASED PRACTICE :
Forward and Inverse Kinematics using Robo Analyzer, Workspace Analysis of a 6 axis robot

TEXTBOOKS

5. *S.K.Saha, "Introduction to Robotics", Second Edition, McGraw Hill Education (India) Private Limited, 2014.*
6. *Roland Siegwart and Illah R.Nourbakhsh, "Introduction to Autonomous Mobile Robots", Prentice Hall of India (P) Ltd., 2005.*

REFERENCE BOOKS

1. B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, "Robotics: Modelling, Planning and Control", First Edition,
   Springer-Verlag London,2009
2. K.S. Fu, R.C Gonzalez and C.S. Lee, "Robotics- Control, Sensing, Vision and Intelligence", Tata McGraw-Hill
   Editions, 2008.
3. John J.Craig, "Introduction to Robotics, Mechanics and Control", Third Edition, Pearson Education, 2005.
4. Mark W.Spong, M.Vidyasagar, "Robot Dynamics and Control", Wiley India, 2009.

COURSE DESIGNERS

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17EECC81	**ELECTRIC CIRCUITS LAB**	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The significance of the Electric Circuit Lab is renowned in the various fields of engineering applications. For an Electrical Engineer, it is obligatory to have the practical ideas about the Electric Circuits

PREREQUISITE

NIL

COURSE OBJECTIVES

1	Understand and gain knowledge about circuit laws and theorems.
2	Gain knowledge about time domain analysis of circuit transients.
3	Understand the concept of resonance in series and parallel circuits.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Analyze and solve the Electrical circuits	Analyze
CO2	Knowledge about circuit theorems and apply in analysing problems in power system	Apply
CO3	Perform analyse of coupled circuits and transient response of circuits.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	M	S	-	S	M	S	M	S	M	-
CO2	S	S	S	S	S	S	S	-	S	M	S	M	S	M	-
CO3	S	S	S	M	M	M	S	-	S	M	S	L	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. Verification of Ohm's Law
2. Verification of Kirchhoff's laws
3. Verification of Thevenin's Theorem
4. Verification of Norton's Theorem
5. Verification of Superposition theorem
6. Verification of Reciprocity theorem
7. Verification of Maximum Power Transfer theorem
8. Time Domain analysis of RL transient circuits
9. Time Domain analysis of RC transient circuits
10. Series Resonance Circuit
11. Parallel Resonance Circuit
12. Three Phase Power Measurement by Two Wattmeter method

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	E-Mail ID
1.	R. SATHISH	Assistant Professor	EEE	sathish@vmkvec.edu.in
2.	D. SARANYA	AP/GRADE-II	EEE	

17ECCC93	SEMICONDUCTOR DEVICES AND CIRCUITS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The goal of this lab is to supplement the theory course Semiconductor Devices & Circuits. Students will gain experience by examining the characteristics of various semiconductor devices such as Diodes, BJTs & FETs. To improve ability of students to design the analog circuits with which services for many practical applications.

PRERQUISITE : NIL

COURSE OBJECTIVES

1	To understand the characteristics of a Diodes.
2	To obtain the characteristics and parameters of transistors BJT/FET.
3	To find the frequency response of feedback amplifiers.
4	To study the performance of waveform generator and wave shaping circuits.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Experiment the characteristics of BJT's & FET's with various configurations.	Apply
CO2. Determine ripple factor for the half wave & full wave Rectifier circuits	Apply
CO3. Determine the frequency of Feedback amplifiers & Oscillators.	Apply
CO4. Classify the waveforms of Wave shaping circuits & Feedback amplifiers circuits.	Analyze
C05. Measure the efficiency of Power & Tuned amplifiers.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	-	-	M	-	-	L	S	-	-
CO2	S	M	M	-	M	-	-	-	M	-	-	M	S	-	-
CO3	S	M	M	-	M	-	-	-	M	-	-	L	S	M	-
CO4	S	S	M	-	-	-	-	-	M	-	M	L	S	M	-
CO5	S	S	L	M	-	-	-	-	M	-	M	M	S	M	-

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. To study experimentally the characteristics of Diodes, BJT's and FET's.
2. To plot the input and output characteristics of a transistor in CE Configuration and to compute the h – parameters
3. To study Drain characteristics and Transfer characteristics & to find the Transconductance, Drain resistance and Amplification factor of JFET
4. Simulation & Hardware realization of Half wave & Full wave Rectifier with and without Filter.
5. Simulation & Hardware realization of Clipping & Clamping circuits..
6. Simulation & Hardware realization of Voltage Series Feedback amplifiers and its frequency analysis
7. Design, Simulation and Hardware realization of Sinusoidal waveform generators.
    a. RC Oscillators
    b. LC Oscillators
8. Design and simulation of Power amplifiers
9. Frequency Response characterization of Single Tuned amplifier circuit.
10. Miniproject.

COURSE DESIGNERS

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17EECC82	ELECTRICAL TECHNOLOGY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To acquire knowledge on the working of various DC machines and Transformers.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	Obtain the performance and characteristics of Electrical machines.
2	Gain knowledge about speed control techniques on DC Machines
3	Compute the efficiency and regulation of a single phase transformer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Analyze the performance characteristics of different types of DC machines.	Analyze
CO2	Compute the efficiency and regulation of a single phase transformer.	Evaluate
CO3	Testing of a DC Machine to monitor the efficiency.	Apply
CO4	Obtain the characteristics of AC Machines	Apply
CO5	Explain the Starters of DC & Induction Machines	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	M	-	-	-	-	-	S	L	-	-	S	-	M
CO2	M	L	M	-	-	-	-	-	S	L	-	-	S	-	M
CO3	M	L	M	-	-	-	-	-	S	L	-	-	S	-	M
CO4	M	L	M	L	L	-	-	-	S	L	-	-	S	-	M
CO5	M	L	M	-	-	-	-	-	S	L	-	-	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. Load test on DC shunt motor
2. Load test on DC series motor
3. Speed control of DC shunt motor

4. Open circuit and load characteristics of DC generator (Self and Separately Excited)
5. Load test on single phase transformer
6. Swinburne's test
7. Load test on 3-phase induction motor.
8. No load and blocked rotor test on 3-phase induction motor.
9. Load test on 1-phase induction motor
10. V and inverted V curve of synchronous motors
11. Study of induction motor Starters
12. Study of DC Starters.

COURSE DESIGNERS

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1	D.SARANYA	Assistant Professor (Gr-II)	EEE/AVIT	srnlekha@gmail.com
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17EECC83	ELECTRICAL MACHINES-I LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To acquire knowledge on the working of various DC machines and Transformers.

PREREQUISITE : 17EEES03- Basics Electrical and Electronics Engineering.

COURSE OBJECTIVES

1	To obtain the performance and characteristics of Electrical machines.
2	To gain knowledge about speed control techniques on DC Machines
3	To compute the efficiency and regulation of a single-phase transformer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO 1: Study the performance characteristics of different types of DC machines.	Apply
CO 2: Compute the efficiency and regulation of a single-phase transformer.	Analyze
CO 3: Testing of Transformer for Modelling	Evaluate
CO4: Testing of a DC Machine and to monitor the efficiency.	Evaluate
CO 5: Explain the Transformer connections	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	-	-	-	-	-	S	L	L	L	S	M	-
CO2	S	L	M	-	-	L	L	-	S	L	L	M	S	M	-
CO3	S	L	M	-	-	L	L	-	S	L	L	M	S	M	L
CO4	S	L	M	L	L	L	L	-	S	L	L	M	S	M	L
CO5	S	L	M	-	-	-	-	-	S	L	L	L	S	M	-

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. *Load test on DC shunt motor.*
2. *Load test on DC series motor.*
3. *Speed control of DC shunt motor.*
4. *Open circuit and load characteristics of DC generator (Self and Separately Excited).*
5. *Load test on dc compound generator.*
6. *Load test on single phase transformer.*
7. *Open circuit & Short circuit test on single phase transformer.*
8. *Swinburne's test.*
9. *Separation of Losses in single phase transformer.*
10. *Hopkinson's test.*
11. *Sumpner's test on 1-phase transformer.*
12. *Study of three phase transformer connections.*
13. *Study of DC Starters.*

Reference Books

Laboratory Reference Manual

COURSE DESIGNERS

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17EECC 84	MEASUREMENTS AND INSTRUMENTATION LAB	Category	L	T	P	C
	Total Contact Hours – 45	CC				
	Prerequisite – NIL					
	Co-requisite - NIL					

Preamble
To develop skills in designing and conducting experiments related to applications of measuring instruments and transducers.

COURSE OBJECTIVES	
1	Gain knowledge about the working of various Transducers
2	To give exposure to AC, DC bridges and transient measurement
3	To train the students in the measurement of displacement, resistance, inductance, torque and angle etc

COURSE OUTCOMES		
On successful completion of the course, the students will be able to		
CO 1	Analyze the performance of various transducers.	Apply
CO 2	Compute the values of various bridges.	Apply
CO 3	Testing of the transformers for their efficiency.	Apply
CO 4	Knowledge about the conversion techniques.	Apply
C0 5	About the power and power factor measurement.	Apply

Mapping with Programme outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	S					S	L		M	S	M	-
CO2	M	L	M						S	L		-	S	M	-
CO3	M	L	M						S	L		M	-	-	-
CO4	M	L	M	L	L				S	L		-	-	-	-
CO5	M	L	M						S	L		M	-	-	-

Sl No	LIST OF EXPERIMENTS
1	Study of displacement and pressure transducers (LVDT).
2	Measurement of water level using capacitive Transducer
3	Measurement of strain using strain Gauge
4	Study of temperature measuring transducers (Thermocouples).
5	AC Bridges.

6	DC Bridges.
7	Instrumentation amplifiers.
8	A/D and D/A converter.
9	Calibration of Current Transformer
10	Calibration of Single phase Energy meter.
11	Calibration of Three phase Energy meter.
12	Measurement of Three phase power and power factor.
REFERENCE	
1	Laboratory Reference Manual

COURSE DESIGNERS

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3	Dr. R. Sankarganesh	Associate Professor	EEE	sankarganesh@vmkvec.edu.in

17EECC85	ELECTRICAL MACHINES – II LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The course provides basic knowledge about the AC machines and to provide opportunity to identify and analyze the various performance factors in different load and no-load conditions

COURSE OBJECTIVES

1	To determine the voltage regulation of an alternator from test data and analyze the effect of various factors such as armature resistance, armature reactance, leakage reactance and power factor on regulation.
2	To formulate of two reaction model of salient pole synchronous machines from test data and predetermine the voltage regulation using quadrature axis and direct axis reactance.
3	To determine the performance of single phase and three phase induction motor from test data and analyze the effect of speed, power factor, line current and efficiency under different loading conditions.
4	To employ the different starting and speed control methods of three phase induction motor.
5	To study about construction and principle operation of Linear and Synchronous induction motor.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1:Predetermine the regulation of Alternator.	Remember
CO2: Analyze the Performance and plot the characteristics of Alternator at different load conditions.	Analyze
CO3:Determine the effect of excitation on armature current and power factor of synchronous motor.	Understand
CO4: Evaluate the performance of three phase induction motor through the load characteristics and circle diagram.	Evaluate
CO5: Apply the suitable speed control method for any specifical applications.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S	S	-	-	-	M	-	-	-	-	L	-	L	L	-
CO2	S	M	L	-	L	M	-	-	-	-	M	-	L	M	-
CO3	S	M	L	S	L	M	-	-	-	-	M	-	L	M	-
CO4	S	L	M	S	L	M	-	-	-	-	L	-	L	M	-
CO5	S	M	S	-	-	-	-	-	-	-	L	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

Sl No	LIST OF EXPERIMENTS
1	Regulation of 3-phase Alternator by EMF and MMF methods.
2	Regulation of 3-phase Alternator by ZPF and ASA method.
3	Slip test on 3-phase Alternator.
4	Load characteristics of 3-phase Alternator by bus bar loading
5	V and inverted V curve of Synchronous motors.
6	Load test on 3-phase Induction motor
7	Load test on 1-phase Induction motor.
8	No load and Blocked Rotor test on three phase induction motor.
9	Equivalent circuit and pre – determination of performance characteristics of single-phase Induction motor.
10	Separation of losses in three-phase induction motor.
11	Speed control of three phase induction motor
12	Study of Linear induction motor and Synchronous Induction motor.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr.A. Balamurugan	Assistant Professor	EEE/VMKVEC	balamurugan@vmkvec.edu.in
2.	Mr.G.Ramakrishnaprabu	Assistant Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in
3.	Mr.S.Prakash	Assistant Professor (Gr-II)	EEE/AVIT	sprakash@avit.ac.in

17ECCC82	DIGITAL LOGIC CIRCUITS & DESIGN LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To provide experience & explore designs in analyzing and testing of digital logic circuits like combinational and sequential circuits using lab instruments as well as simulation software.

Prerequisite : Basic Electrical and Electronics Engineering

PRERQUISITE

17EEES03 - Basics of Electrical and Electronics Engineering

COURSE OBJECTIVES

1	To impart the knowledge in analysis and design of various combinational logic circuits.
2	To learn about design and analysis of sequential circuits using flip flops.
3	To Expose students about design and simulation of logic circuits using HDL.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Construct various logic circuits.	Apply
CO2. Demonstrate the various combinational logic circuits by using discrete components	Apply
CO3. Analyze different sequential logic circuits by using discrete components.	Analyze
CO4. Test the various digital logic circuits by using simulation software.	Evaluate
CO5. Measure and record the experimental data for various digital circuits.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	-	-	-	M	-	-	L	-	-	-
CO2	S	-	-	-	S	-	-	-	M	-	-	L	S	-	-
CO3	S	M	M	M	M	-	-	-	M	-	-	L	-	-	-
CO4	S	M	-	-	M	-	-	-	M	-	-	L	M	M	M
CO5	S	M	-	-	M	-	-	-	M	-	-	L	-	M	-

S- Strong; M-Medium; L-Low

List of Experiments

Hardware Experiments

1. Design and implementation of Adders using logic gates.
2. Design and implementation of Sub tractors using logic gates.
3. Design and implementation of BCD to Excess -3 code converter using logic gates
4. Design and implementation of Binary to Gray code converter using logic gates
5. Design and implementation of 4 bit BCD adder using IC 7483
6. Design and implementation of 2 Bit Magnitude comparator using logic gates
7. Design and implementation of Multiplexer and De-Multiplexer using logic gates
8. Design and implementation of encoder and decoder using logic gates
9. Design and implementation of 3 bit synchronous up/down counter.
10. Implementation of SISO, SIPO, and PISO shift registers using flip flops.

Software Experiments using HDL

1. Design and Simulation of Full adder circuit using Gate level modelling
2. Design and Simulation of 2X2 multiplier circuit using structural level modeling.
3. Design and Simulation of 8 to 1 Multiplexer circuit using behavioural level modeling.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.B.Rajasekaran	Associate Professor	ECE	rajasekaran@vmkvec.edu.in
2	Mrs.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in
3	Ms.R.Mohana Priya	Assistant Professor (Gr-II)	ECE	mohanapriya@avit.ac.in

17EECC86	POWER ELECTRONICS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To acquire the practical knowledge in power electronic devices and circuits. Students will be able to understand and analyze power converters such as AC-DC converters, DC-DC converters, DC-AC converters, AC-AC converters and their control circuits for real world applications.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	To conduct experiments on semiconductor devices to obtain their characteristics.
2	To understand the performance of single phase half & full controlled rectifier and AC voltage controller.
3	To study the performance of chopper & cycloconverter.
4	To control the speed of a dc motor and induction motor.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Analyze the performance characteristics of semiconductor devices by conducting suitable experiments.	Analyze
CO2: Compare the performance of controlled rectifiers & chopper by conducting suitable experiments.	Apply
CO3: Analyze the performance characteristics of AC voltage controller & cycloconverter by conducting suitable experiments.	Analyze
CO4: Control the speed of DC motor & Induction motor by conducting suitable experiments.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	L	M				S		M			S	
CO2	S	M	L	M	M				S		S			S	
CO3	S	M	L	S	M				S		M			S	
CO4	S	M	L	M	S				S		S			S	

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Characteristics of SCR& TRIAC
2. Characteristics of MOSFET and IGBT
3. AC to DC Half controlled converter
4. AC to DC fully controlled converter
5. Voltage Commutated Chopper

6. Resonant dc to dc converter
7. AC Voltage Controller
8. Single Phase Cyclo-converter
9. Converter fed DC Motor Drive.
10. Inverter fed Induction Motor Drive.

Reference Books

Laboratory Reference Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Sankarganesh	Associate Professor	EEE/VMKVEC	sankarganesh@vmkvec.edu.in
2	Mr. N. P. Gopinath	Assistant Professor	EEE/AVIT	gopinathnp@avit.ac.in

17ECCC94	LINEAR INTEGRATED CIRCUITS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE:

To acquire knowledge on designing amplifier and oscillator circuits using operational amplifiers.

PRERQUISITE – NIL

COURSE OBJECTIVES

1. To Learn the design of basic operational amplifier circuits.
2. To provide the knowledge of designing application circuits using operational amplifiers.
3. To understand the functionality of the circuits using op-amp and IC555.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Design and verify the performance of basic circuits with Op-Amp used as inverting, Non-Inverting amplifier, Integrator and Differentiator, etc.	Apply
CO2. Realize and Simulate the circuit for various applications using operational amplifiers.	Analyze
CO3. Realize active networks using driving point functions and transfer functions using simulation tools.	Analyze
CO4. Demonstrate the use of Phase Locked Loops (PLL) and IC 555 Timers using simulation tools.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	-	-	-	-	-	M	-	-	L	-	-	-
CO2	S	S	S	-	M	-	-	-	M	-	-	L	S	M	-
CO3	S	S	S	M	M	-	-	-	M	-	-	L	S	M	-
CO4	S	S	S	M	M	-	-	-	M	-	-	M	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. Design of Inverting and Non-Inverting amplifier using operational amplifier.
2. Design of Adders and Subtractors using operational amplifier.
3. Design of Integrators and Differentiators using operational amplifiers.
4. Design of comparators using operational amplifiers.
5. Design of rectifiers using operational amplifiers.
6. Design of oscillators using operational amplifier.
7. Design of Astable and Monostable Multivibrators using IC555 Timer
8. Design of filters using operational amplifier.
9. Design of Digital to analog converter and Analog to Digital converters.
10. Design and implementation of Phase Locked Loops.

REFERENCE

1. Laboratory Reference Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	R.Karthikeyan	Assistant Professor (Gr-II)	ECE	rrmdkarthikeyan@avit.ac.in
2	N.Manikanda Devarajan	Assistant Professor	ECE	manikandadevarajan@vmkvec.edu.in
3	G.Suresh kumar	Assistant Professor	ECE	sureshkumar@vmkvec.edu.in

17EECC87	CONTROL SYSTEMS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

Control Systems simulation Lab consists of multiple workstations, each equipped with an oscilloscope, digital multi-meter, PID trainers, control system trainers and stand alone inverted-pendulum, ball and beam control, magnetic-levitation trainers. This lab also covers the industrial implementation of advanced control systems via different computer tools such as MATLAB and Simulink.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2	To assess the system performance using time domain analysis and methods for improving it
3	To assess the system performance using frequency domain analysis and techniques for improving the performance
4	To design various controllers and compensators to improve system performance

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	How to improve the system performance by selecting a suitable controller and/or a compensator for a specific application	Understand
CO2	Apply various time domain and frequency domain techniques to assess the system performance	Apply
CO3	Apply various control strategies to different applications(example: Power systems, electrical drives etc)	Analyze
CO4	Test system controllability and observability using state space representation and applications of state space representation to various systems	Analyze and Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L	M	S	-	-	-	M	L	-	L	S	M	S
CO2	S	S	L	M	S	-	-	L	M	L	M	-	S	M	-
CO3	S	S	S	M	S	-	L	-	M	L	-	M	S	M	S
CO4	S	S	-	M	S	L	-	-	M	L	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. Transfer function of self and separately excited DC Generator.
2. Transfer function of Armature and Field controlled DC Motor.
3. Transfer function of AC Servomotor.

4. Frequency response of Lag, Lead & Lag – Lead networks.
5. Study of Synchros and DC Stepper Motor
6. Transfer function of Ward – Leonard method of speed control of DC motor.
7. Study of DC Position Control system and study of various transducers
8. *Study of P, PI and PID Controllers (First Order).*
9. Analog and simulation of type – o and type – 1 systems
10. Stability analysis of Linear Systems
11. Digital simulation of first order systems
12. Digital simulation of second order systems

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-mail id
1.	R. SATHISH	Assistant Professor	EEE	sathish@vmkvec.edu.in
2.	N.P. GOPINATH	Assistant Professor GR-II	EEE / AVIT	gopinathnp@avit.ac.in

17EECC88	POWER SYSTEM SIMULATION LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To acquire software development skills and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To study the power system planning and operational studies.
2	To study the Formation of bus admittance and impedance matrices and network solutions.
3	To study the Power flow solution of small systems using simple method, Gauss-Seidel P.F. method
4	To study the Unit Commitment and Economic Dispatch
5	To acquire experience in the usage of standard packages for the following analysis / simulation / control functions

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the power system planning and operational studies	Understand
CO2: Explain the procedure of bus admittance and impedance matrices and network solutions.	Understand
CO3: Solve the Power flow problems using GS and NR method.	Analyze
CO4: Detect Symmetric and Unsymmetrical fault.	Analyze
CO5: Describe the unit commitment economic dispatch	Understand
CO6: Design the electromagnetic transient circuits.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	-	-	-	-	-	-	-	-	-	-	S	S	M
CO2	S	S	S	-	S	-	-	-	M	M	-	-	S	S	M
CO3	S	S	S	-	-	-	-	-	-	-	-	-	S	S	M
CO4	-	S	-	-	S	-	-	-	M	M	-	-	S	S	M
CO5	S	S	S	-	-	-	-	-	-	-	S	-	S	S	M
CO6	S	-	S	-	S	-	-	-	-	-	-	-	S	S	M

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Network Matrices and Solution of Networks.
3. Power Flow Analysis - I: Solution of Power Flow and Related Problems Using Gauss-Seidel Method.
4. Power Flow Analysis II: Solution of Power Flow and Related Problems Using Newton-Raphson and Fast-Decoupled Methods.
5. Short Circuit Analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multimachine Power Systems.
8. Electromagnetic Transients in Power Systems.
9. Load – Frequency Dynamics of Single and Two-Area Power Systems.
10. Unit Commitment and Economic Dispatch in Power Systems.

REFERENCE BOOKS

1. Laboratory reference manual.

OURSE DESIGNERS

No.	Name of the Faculty	Designation	Department	Mail ID
1	V.MANJULA	Assistant Professor	EEE/VMKVEC	manjula@vmkvec.edu.in
2	S.PRAKASH	Assistant Professor(Gr-II)	EEE/AVIT	sprakash@avit.ac.in

17EECC89	SOLID STATE DRIVES LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

This laboratory gives a practical exposure to the students to learn about function and simulation of AC and DC drives. The students will be able to design and analyze AC and DC drives.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	To construct DC choppers circuit for analyse the performance by conducting suitable experiments.
2	To analyse the performance characteristics of the given AC drive by conducting suitable experiments.
3	To simulate AC and DC driver circuits using MATLAB-Simulink.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Construct DC choppers for the given specifications experimentally.	Apply
CO2: Analyze the performance characteristics of AC driver circuit by conducting suitable experiments.	Analyze
CO3: Construct AC and DC driver circuits using MATLAB-Simulink.	Apply
CO4: Evaluate the performance of the given AC and DC driver circuits using MATLAB-Simulation.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	M										S	
CO2	S	M	S	M										S	
CO3	S	L	M	M	S						S			S	
CO4	S	M	S	M	S						S			S	

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. *Converter fed DC Motor Drive.*
2. *Inverter fed Induction Motor Drive.*
3. *V/F Control of VSI Fed Induction Motor.*
4. *Rotor Resistance Control of Induction Motor.*
5. *Simulation of PWM inverter fed single phase induction motor control*
6. *Simulation of PWM inverter fed three phase induction motor control*
7. *Simulation of CSI fed induction motor drive analysis*
8. *Simulation of VSI fed induction motor drive analysis*

Reference Books

Laboratory Reference Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Sankarganesh	Associate Professor	EEE/VMKVEC	sankarganesh@vmkvec.edu.in
2	Dr. K. Boopathy	Professor	EEE/AVIT	boopathyk@avit.ac.in

17ECCC95	MICROCONTROLLERS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE:

Microcontroller is one of the usually used methods in many electronic systems and automatic devices. It is essential to know their operation and how they can be used in automated control system applications. The main objective of this lab course is to gain the practical hands on experience of programming the 8086 microprocessor and 8051 microcontroller and gain knowledge on interfacing of different peripherals to microcontroller. Students can be able to write the assembly language programming skills, knowledge in interfacing devices and real time applications of microcontroller.

PRERQUISITE – Nil

COURSE OBJECTIVES

1. To Learns Assembly Language Programming For Arithmetic Operations Using 8051.
2. To Study The Various Peripheral Devices And Interfacing With Microcontroller.
3. To Expand Writing Skills For Assembly Language Programming For Microcontroller.
4. Develop Assembly Language Programs For Various Applications Using 8051 Microcontroller.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Write ALP Programming For Microprocessor And Microcontroller	Understand
CO2. Interface Different I/Os With Microcontroller	Apply
CO3. Generate Different Waveforms Using Microcontroller	Apply
CO4. Design Circuits For Various Applications Using Microcontrollers	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	--	S	--	--	--	S	L	--	M	-	-	--
CO2	S	S	M	--	S	M	--	--	S	L	--	M	S	S	-
CO3	S	S	M	--	S	M	--	--	S	L	--	M	S	-	-
CO4	S	S	M	--	S	S	--	--	S	L	--	M	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

<u>LIST OF EXPERIMENTS</u>

1. *8085 & 8086 Assembly Language Program (ALP) for Arithmetic Operations.*
2. *8051 Assembly Language Program (ALP) for Arithmetic Operations.*
3. *8051 Assembly Language Program (ALP) for Logical Operations.*
4. *8051 Assembly Language Program (ALP) for Bit Manipulation Operations.*
5. *8051 Assembly Language Program (ALP) for arrange the numbers in Ascending and Descending order.*
6. *8051 Assembly Language Program (ALP) for Interrupt & UART Operations.*
7. *Interfacing an ADC to 8051 Controller.*
8. *Interfacing DAC to 8051 Controller and generate Square, Triangular & Saw-tooth waveform.*

9. *Interfacing a Stepper motor to 8051 Controller and operate it in clockwise and anti-clockwise directions.*

Interfacing a Keyboard & Display controller (8279) to 8051 Controller.

REFERENCE

1. Laboratory Reference Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1	Mr. R.Karthikeyan	rrmdkarthikeyan@avit.ac.in
2	Dr. R.Ramani	ramaniapece@gmail.com
3	Mr. N.Manikandadevarajan	manikandadevarajan@vmkvec.edu.in
4	Mr. G.Suresh kumar	sureshkumar@vmkvec.edu.in

17EEEC01	**ADVANCED CONTROL SYSTEM**	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

This course introduces systematic approaches to the design and analysis of control systems for industrial applications which aims at giving an adequate exposure in state space analysis, state space controller design, MIMO system, Non-linear system, stability analysis. The course will be of particular interest to automation engineers employed in various industries, such as the process, energy, water, oil & gas, pharmaceutical and food industries, who are involved with process automation and control, either in the design or development of control systems, their application, operation and management

PREREQUISITE

1. 17EECC08 Control systems

COURSE OBJECTIVES

1	Gain comprehensive knowledge about structures of modern computer control systems
2	Develop an awareness of available design tools
3	Become familiar with the methodologies available for applying control in single loop
4	Gain an understanding of the dynamics of processes and modelling methods
5	Gain an understanding of the design process for continuous and discrete controllers for these systems

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Develop the mathematical model of the system.	Understand
CO2	Gain the knowledge on basic concepts of stability and analyze the stability of the system.	Understand
CO3	Formulate and analyze the describing functions of non linear systems.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	S	M	-	M	L	-	-	-	-	-	M	-	-	S
CO2	S	M	M	-	M	L	M	-	M	-	-	M	M	S	M
CO3	-	M	M	-	M	-	-	-	-	-	-	-	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

STATE VARIABLE ANALYSIS

Concept of state – State Variable and State Model – State models for linear and continuous time systems – Solution of state and output equation – controllability and\ observability - Pole Placement – State observer

Design of Control Systems with observers.

PHASE PLANE ANALYSIS

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

DESCRIBING FUNCTION ANALYSIS

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

STABILITY ANALYSIS

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

OPTIMAL CONTROL

Introduction -Decoupling - Time varying optimal control – LQR steady state optimal control – Optimal estimation – Multivariable control design.

TEXT BOOKS

1. I.J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.

2. Ashish Tewari, 'Modern control Design with Mat lab and Simulink', John Wiley, New Delhi, 2002.

3. Sarkar B.N , 'Advanced Control Systems' Prentice Hall India Learning Private Limited (2013)

REFERENCE BOOKS

1. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.

2. M.Gopal, Modern control system theory, New Age International Publishers, 2002.

3. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, " Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition. 2002.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
1.	R. SATHISH	Assistant Professor	EEE/VMKVEC	sathish@vmkvec.edu.in
2.	N.P. GOPINATH	Assistant Professor AP.GR-II	EEE / AVIT	gopinathnp@avit.ac.in

17EEEC02	ADVANCED TOPICS IN POWER ELECTRONICS	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE:

This course imparts knowledge about modern power electronic converters and its applications in electric power utility like low power SMPS and UPS technologies

PREREQUISITE : 17EECC06 Power Electronics.

COURSE OBJECTIVES

1	To study the operation, switching techniques and basics topologies of DC-DC switching regulators
2	To analyse the operation, characteristics and performance parameters of switching mode power converters.
3	To study the operation of resonant converters and concept of Zero voltage Switching.
4	To learn the concept and operation of Inverters and different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5	To study the operation of various power electronics applications like UPS and filters.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the operation, switching techniques and basics topologies of DC-DC switching regulators	Understand
CO2: Analyse the operation, characteristics and performance parameters of switching mode power converters.	Analyse
CO3: Interpret the operation of resonant converters and concept of Zero voltage Switching.	Apply
CO4: Explain the concept and operation of Inverters and different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.	Understand
CO5: Illustrate the operation of various power electronics applications like UPS and filters.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M		S			M				L		M	L	
CO2	S	M		L						M	M	M	M	S	
CO3	S	L		M	S						M		L	L	
CO4	S	L		S		M	M			M	S	M	M	S	M
CO5	S	L	S	S	S	M	M			M	S	M	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

DC-DC CONVERTERS

Principles of stepdown and stepup converters – Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

SWITCHING MODE POWER CONVERTERS

Analysis and state space modeling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques.

RESONANT CONVERTERS

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control .

DC-AC CONVERTERS

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters-Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

POWER CONDITIONERS, UPS & FILTERS

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

TEXT BOOKS:

1. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design- Third Edition- John Wiley and Sons- 2006

2. M.H. Rashid – Power Electronics circuits, devices and applications- third edition Prentice Hall of India New Delhi, 2007.

REFERENCES:

1. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
2. Kjeld Thorborg, "Power Electronics – In theory and Practice", Overseas Press, First Indian Edition 2005.
3. Philip T Krein, " Elements of Power Electronics", Oxford University Press, 1998.
4. Slobodan Cuk , "Power Electronics: Advanced Topics and Designs", Publisher: Slobodan Cuk, 3 edition, ISBN-13: 978-1519520296, 2016.

COURSE DESIGNERS

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2	Dr. G. Ezhilarasan	Professor	EEE/AVIT	Ezhilarasan.eee@avit.ac.in

17EEEC03	COMPUTER AIDED DESIGN OF ELECTRICAL APPARATUS	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

To understand and familiarize the principle, Concepts of Computer Aided Design technology for the design of Electrical Machines.

COURSE OBJECTIVES

1	Learn the importance of computer aided design method.
2	Understand the basic electromagnetic field equations and the problem formulation for CAD applications.
3	Become familiar with Finite Element Method as applicable for Electrical Engineering.
4	Know the organization of a typical CAD package.
5	Apply Finite Element Method for the design of different Electrical apparatus.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Understand the concept of electromagnetic energy conversion and designing parameters.	Understand
CO2: Familiarize the mathematical expressions for different field problems.	Understand
CO3: Implement the concepts of FEM to design the apparatus	Apply
CO4: Analyze the performance of electrical apparatus through the concepts of CAD	Analyze
CO5: Design the electrical apparatus.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	M	-	-	-	-	-	-	-	-	S	M	M
CO2	S	M	-	-	-	-	-	-	-	-	-	-	M	M	M
CO3	S	S	M	M	M	-	-	-	-	-	-	-	M	S	M
CO4	S	S	M	M	M	-	-	-	-	-	-	-	M	S	M
CO5	S	S	S	M	S	-	-	-	-	-	-	--	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION

Conventional design procedures – Limitations – Need for field analysis based design –Review of Basic principles of energy conversion – Development of Torque/Force.

MATHEMATICAL FORMULATION OF FIELD PROBLEMS

Electromagnetic Field Equations – Magnetic Vector/Scalar potential – Electrical vector / Scalar potential – Stored energy in Electric and Magnetic fields – Capacitance – Inductance- Laplace and Poisson's Equations – Energy functional.

PHILOSOPHY OF FEM

Mathematical models – Differential/Integral equations – Finite Difference method – Finite element method – Energy minimization – Variational method- 2D field problems – Discretisation – Shape functions – Stiffness matrix – Solution techniques.

CAD PACKAGES

Elements of a CAD System –Pre-processing – Modelling – Meshing – Material properties- Boundary Conditions – Setting up solution – Post processing.

DESIGN APPLICATIONS

Voltage Stress in Insulators – Capacitance calculation – Design of Solenoid Actuator – Inductance and force calculation – Torque calculation in Switched Reluctance Motor.

TEXT BOOKS

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor& Francis, 2005.

REFERENCES

1. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by Finite Element Methods', Marcell Dekker Inc., 2003.
2. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge University Press, 1983.
3. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer Verlag, New York, 1986.
4. S.R.H.Hoole, 'Computer Aided Analysis and Design of Electromagnetic Devices', Elsevier, New York, 1989.
5. User Manuals of MAGNET, MAXWELL & ANSYS Softwares.

COURSE DESIGNERS

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17EEEC04	EHV AC &DC POWER TRANSMISSION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To provide an in depth understanding of the different aspects of EHVAC&DC power transmission with its advantages and applications.

PREREQUISITE :TRANSMISSION AND DISTRIBUTION(17EECC07)

COURSE OBJECTIVES

1	To use the different types of AC and DC links with its advantages and applications.
2	To learn the different compensation techniques.
3	To understand the concept of travelling waves, types of over voltage in the transmission line.
4	To study the different components used in EHV system.
5	To observe the various problems occur in EHV DC system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the different types of AC and DC links with its advantages and applications.	Understand
CO2: Define the shunt and series compensation and concept of FACT with application	Remember
CO3: Explain the concept of travelling waves on transmission line and the overvoltage in transmission system.	Understand
CO4: Differentiate the various control of EHV DC system.	Analyze
CO5: Describe the converter faults and protection harmonics misoperation.	Understand
CO6: Solve the problems of EHV DC system.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	S	M	L	M	L	--	--	--	--	--	L	M	L	--
CO2	L	S	M	M	M	L	--	--	--	--	--	M	M	M	--
CO3	M	L	M	L	L	L	--	--	--	--	--	L	M	L	--
CO4	--	L	L	L	S	L	--	--	--	--	--	L	S	M	M
CO5	--		M	--	M	L	--	--	--	--	--	L	S	M	--
CO6	S	S	S	M	--	L	--	--	--	--	--	M	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

GENERAL ASPECTS OF DC TRANSMISSION AND COMPARISON OF IT WITH AC TRANSMISSION

Constitution of EHV AC and DC links, Kinds of DC links, limitations and advantages of AC and DC transmission principal, application of AC and DC transmission , trends EHV AC and DC transmission, power-handling capacity converter analysis Garentz circuit, Firing control, overlapping.

COMPENSATION TECHNIQUES

Extra long distance lines, voltage profile of loaded and unloaded line along the line, compensation of lines, series and shunt compensation, shunt reactors, Tuned power lines, problem of extra compensation lines, FACT concept and application.

PROTECTION CIRCUITS OF EHV AC AND DC SYSTEM

Travelling waves on transmission system, Their shapes, attenuation and distortion, effect of junction and termination on propagation of traveling waves, over voltage in transmission system, lighting, switching and temporary over voltage: control of lighting and switching over voltage.

POWER QUALITY IN EHV AC AND DC SYSTEM

Components of EHV dc system, converter circuits, rectifier and inverter valves, Reactive power requirements, harmonic generation, adverse effects, classification, Remedial measures to suppress, ,filters, Ground return, converter faults& protection harmonics misoperation, commutation failure, Multi-terminal D,C. lines.

CONTROL OF EHV DC SYSTEM

Control of EHV DC system desired features of control ,control characteristics, constants current control, constant extinction angle control, lgnition angle control, parallel operation of HVAC & DC system, problems and advantage.

TEXT BOOKS

1. Rakesh Das Begamudre, Extra High Voltage AC Transmission Engineering, New Academic Science Limited, 4th edition, March 2011.

2. K.R. Padiyar, HVDC Power Transmission System, New Academic Science Limited, Feb 2011.

REFERENCE BOOK

1. *E.W. Kimbark. EHV-AC and HVDC Transmission Engineering & Practice, Khanna Publishers.*

2. S.Rao, EHV-AC and HVDC Transmission Engineering Practice, Khanna Publishers,2010.

COURSE DESIGNERS

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17EEEC05	FLEXIBLE AC TRANSMISSION SYSTEMS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To develop the knowledge in the area of FACTS controller using different techniques.

PREREQUISITE :TRANSMISSION AND DISTRIBUTION(17EECC07)

COURSE OBJECTIVES

1	To study the different methods used to control the reactive power in transmission line
2	To study the compensation technique for reactive control using static var compensator with its application
3	To study about working principle, Different modes of operation and applications of thyristors controlled series capacitor
4	To study the different voltage source converters based FACTS controllers
5	To study the coordination of FACTS controller using different techniques

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Identify the various FACTS controller and its applications.	Remember
CO2:Explain the concepts about load compensation techniques.	Understand
CO3: Design a modeling of various FACTS Controllers	Create
CO4: Predict the impact of FACTS controllers on AC transmission system.	Analyze
CO5: Differentiate the performance of steady state and transients of facts controllers.	Analyze
CO6: Choose the appropriate FACTS controllers for reactive power compensation in AC transmission system to improve the quality of power.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	S	--	S	M	L	--	--	L	--	M	--	--	S	--
CO2	S	S	--	--	--	--	--	--	--	--	--	--	--	M	M
CO3	S	M	S	--	--	--	--	--	--	--	--	--	S	S	M
CO4	M	--	--	S	--	M	--	--	--	--	--	--	--	M	--
CO5	S	M	M	--	--	--	--	--	--	--	--	--	S	M	--
CO6	--	S	M	--	L	M	--	--	--	--	M	--	--	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Reactive power control in electrical power transmission lines –Uncompensated transmission line – series compensation – Basic concepts of static Var Compensator (SVC) – Thyristor Switched Series capacitor (TCSC) – Unified power flow controller (UPFC).

STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS

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

THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS

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

VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-Enhancement of transient stability – Prevention of voltage instability. SSSC-operation of SSSC and the control of power flow –Modeling of SSSC in load flow and transient stability studies. Applications: SSR Mitigation-UPFC and IPFC.

CO-ORDINATION OF FACTS CONTROLLERS

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

TEXT BOOKS

1.K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, January 2016.

2.R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, January 2011.

REFERENCES

1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons,January 2011.

2. Narain G. Hingorani, "Understanding FACTS –Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, New Delhi,March 2011.

3. K.R.Padiyar," FACTS Controllers in Power Transmission and Distribution", New Age International(P) Limited, Publishers, New Delhi, January 2016.

4. A.T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.

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

COURSE DESIGNERS

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17EEEC06	**HIGH VOLTAGE DIRECT CURRENT TRANSMISSION**	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE:
High voltage direct current transmission has advantages over ac transmission in special situations. With the advent of thyristor valve converters, HVDC transmission became even more attractive. This course deals with the operation, modelling and control of HVDC link in power system.

PREREQUISITE :17EECC07 Transmission and Distribution

COURSE OBJECTIVES

1	Recognize the significance and necessity of HVDC system
2	Describe the power converters and harmonic filters used in HVDC system
3	Determine the requirement of appropriate control strategies and stability techniques used for HVDC system
4	Illustrate suitable controller for HVDC converter to obtain desired output
5	Interpret suitable protection scheme by identifying the fault in the system
6	Identify the application of HVDC system with practical examples

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the significance and necessity of HVDC system	Understand
CO2: Discuss the power converters and harmonic filters used in HVDC system	Understand
CO3: Explain the requirement of appropriate control strategies and stability techniques used for HVDC system	Understand
CO4: Design suitable controller for HVDC converter to obtain desired output	Apply
CO5: Select suitable protection scheme by identifying the fault in the system	Apply
CO6: Explain the application of HVDC system with practical examples	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L				L									
CO2	M	L		M		M		M		M	L	M		M	
CO3	S	M				M	M				M	M		S	
CO4	S	M	L		M	L	M	S		S	S		L	S	
CO5	S	M	L	M	S	S	M	S		S	S			S	L
CO6	M	L			S	M		S		S	S	S		S	

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction

Development of HVDC technology-Significance of DC transmission-Overview and organization of HVDC systems-Review of the HVDC system reliability-HVDC characteristics and economic aspects

Power Conversion and Harmonics

Power conversion - Thyristor, Phase converter, Phase full bridge converter, Pulse converter- Harmonics in HVDC and removal-Determination of resulting harmonic impedance-Active power filter

Control of HVDC Converter and System

Converter control for an HVDC system-Commutation failure- HVDC control and design - HVDC control functions- Reactive power and voltage stability- Interactions between AC and DC systems

Protection of HVDC System

Valve protection functions- Protective action of an HVDC system-Protection by control actions-Fault analysis-Insulation coordination of HVDC

Trends for HVDC Applications

Wind Farm Technology- Modern Voltage Source Converter (VSC)- 800 kV HVDC System- Practical examples of an HVDC system

Text Book

1. Chan-Ki Kim, "HVDC TRANSMISSION Power Conversion Applications in Power Systems", John Wiley & Sons Pvt. Ltd., 2009

Reference Books

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993
2. K.R.Padiyar, "HVDC Power Transmission Systems", New Age International (P) Ltd., New Delhi, 2002.
3. J.Arrillaga, "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
4. Erich Uhlmann, "Power Transmission by Direct Current", BS Publications, 2004.
5. V.K.Sood, "HVDC and FACTS controllers – Applications of Static Converters in Power System", Kluwer Academic Publishers, 2004.
6. Dragan Jovcic, Khaled Ahmed, "High Voltage Direct Current Transmission: Converters, Systems and DC Grids", John Wiley & Sons, Ltd, ISBN:9781118846667, 2015.

COURSE DESIGNERS

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17EEEC07	INTELLIGENT CONTROLLERS	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

Intelligent control achieves automation via the emulation of biological intelligence. It either seeks to replace a human who performs a control task (e.g., a chemical process operator) or it borrows ideas from how biological systems solve problems and applies them to the solution of control problems. This course provides an overview of several techniques used for intelligent control and discusses challenging industrial application domains where these methods may provide particularly useful solutions. The subject begins with a brief overview of the main areas in intelligent control, which are fuzzy control and neural networks

PREREQUISITE

17EECC08 Control systems

COURSE OBJECTIVES

1	Analyze the performance of the controller using fuzzy logic system and neural network for armature controlled DC motor seed control
2	Analyze the performance of neural network and fuzzy logic systemfor system identification
3	Analyze the reason for better generalization capability of SVM as compared to Neural network
4	Analyze the performance of fuzzy based gain scheduling control

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Explain the role of Artificial intelligence in industrial controllers and basics of fuzzy and neural systems.	Understand
CO2	Explain the modeling of a controller using fuzzy and neural systems	Understand
CO3	Apply fuzzy and neural systems for system identification	Apply
CO4	Analyze the performance of the controllers based on fuzzy and neural for industrial applications.	Analyze
CO5	Apply genetic algorithm to Optimal control problems using Simulation Tool Box	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	M	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	M	S	M	M	-	-	-	-	-	-	-	-	-	L
CO3	S	S	S	S	S	M	-	M	-	-	-	-	S	-	-
CO4	S	S	S	S	S	S	M	-	S	-	-	-	S	-	-
CO5	S	L	S	L	S	-	-	-	L	L	-	-	M	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.

ARTIFICIAL NEURAL NETWORKS

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations. Hopfield network, Self-organizing network and Recurrent network. Neural Network based controller

GENETIC ALGORITHM

Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems.

FUZZY LOGIC SYSTEM

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control. Fuzzy logic control for nonlinear time-delay system.

APPLICATIONS

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural-Network interconnection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems.

TEXT BOOKS

1. Padhy.N.P. Artificial Intelligence and Intelligent System, Oxford University Press. (2005),
2. KOSKO,B. "Neural Networks And Fuzzy Systems", Prentice-Hall of India Pvt. Ltd., 1994.
3. Siddique, Nazmul, "Intelligent Control", Springer 2014

REFERENCES:

1. Jacek.M.Zurada, "Introduction to Artificial Neural Systems", Jaico PublishingHouse, 1999.
2. KLIR G.J. & FOLGER T.A. "Fuzzy sets, uncertainty and Information", Prentice-Hall of India Pvt. Ltd., 1993.
3. Zimmerman H.J. "Fuzzy set theory-and its Applications"-Kluwer Academic Publishers, 1994.
4. Driankov, Hellendroon, "Introduction to Fuzzy Control", Narosa Publishers.
5. Goldberg D.E. (1989) Genetic algorithms in Search, Optimization and Machine learning, Addison Wesley.

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17ECEC25	MICRO ELECTRO MECHANICAL SYSTEMS	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

Micro Electro Mechanical System (MEMS) contains components of sizes less than 1 millimeter. MEMS achieve some engineering functions by electro mechanical or electro chemical means. In general a sensor, an actuator and a signal transduction unit forms the MEMS device. Automobile, Aerospace, Health care are some of the areas where MEMS found applications. Natural science, Mechanical, Electrical, Chemical, Materials and Industrial Engineering are the disciplines involved in design, Manufacture and Packaging of MEMS devices. This course provides a comprehensive treatment with synergetic integration of wide spectrum of discipline in science and engineering to cater the multidisciplinary nature of Mechatronics

PREREQUISITE -

COURSE OBJECTIVES

1	To gain basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques
2	This enables them to design, analysis, fabrication and testing the MEMS based components.
3	Introduce the students various opportunities in the emerging field of MEMS.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Summarize the working principles of MEMS and Microsystems	Understand
CO2. Solve problems in scaling laws applicable to miniaturization	Apply
CO3. Explain Materials for MEMS and Microsystems	Apply
CO4. Select micro-system fabrication and Micro-manufacturing process for a given application	Apply
CO5. Explain the packaging aspects of Micro System	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	L	-	-	-	-	-	-	-	L	S	M	-
CO2	S	M	M	M	M	-	-	-	-	-	-	L	S	M	M
CO3	S	M	M	-	-	-	-	-	-	-	-	L	S	M	-
CO4	S	S	M	M	L	-	-	-	-	-	-	L	S	M	M
CO5	S	L	L	-	-	-	-	-	-	-	-	L	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Overview of MEMS and Micro Systems: MEMS and Microsystems, products, Evolution of micro-fabrication, Micro system and Microelectronics, The multidisciplinary nature of MEMS, Miniaturization, applications of micro systems in automotive, health care, aerospace, and telecommunication fields.

Working Principles of Microsystems: Introduction, micro sensors: Acoustic waves, optical, chemical, pressure, thermal, biomedical and bio sensors. Micro actuation: using thermal forces, shape memory alloys, piezoelectric crystals and electrostatics forces. MEMS with micro actuators: micro grippers, micro motors, micro valves, micro pumps, micro accelerometer

Scaling law in miniaturization: Introduction to scaling, scaling in rigid body dynamics, electrostatic forces, electromagnetic forces, electricity, fluid mechanics and heat transfer.

Materials for MEMS and Microsystems: Introduction, substrate and wafers, active substrate materials, silicon, silicon compounds, silicon piezoresistors, polymers and packaging materials.

Microsystem fabrication process: Introduction, Photolithography, ion implantation, diffusion, oxidation, chemical vapour deposition, physical vapour deposition (sputtering), Deposition by epitaxy, wet and plasma etching.

Overview of Micro manufacturing: Introduction, bulk micromachining, surface micromachining, the LIGA process. Microsystem packaging: Introduction, Microelectronics packaging, Microsystem packaging, Interfaces in microsystem packaging, Essential packaging technologies, Pressure sensor packaging

TEXTBOOKS

3. Tai –Ran Hsu, “MEMS and Microsystem: Design and Manufacture ”, Tata McGraw Hill, First Edition, 2002.

REFERENCE BOOKS

1. G.K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Athrae “Micro and Smart System”, Wiley India Pvt Ltd, First edition, 2010.
4. Chang Liu , “Foundation of MEMS”, 2nd Edition, Pearson education, 2012.
5. Gad El Hak (Editor), “The MEMS Hand Book”, Three volume set, 2nd revised Edition.CRC press, 2005.

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17EEEC09	**POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEM**	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course will cover the applications of renewable energy systems, Power electronic circuits are an essential component of renewable and distributed energy sources including wind turbines, photovoltaic, marine energy systems and energy storage systems. This course covers the design and implementation of power electronic devices for off-grid and grid connected renewable energy systems. Power quality issues in renewable energy systems are investigated and some solutions are presented.

PREREQUISITE

- 17EECC06 Power Electronics

COURSE OBJECTIVES

1	To Understand the basics of renewable Energy and its applications
2	To study the different types of renewable energy sources and its features
3	To understand the operations of power converters in wind turbines.
4	To analyze and design grid connected converter systems for renewables
5	To analyze the techniques for integrating multiple renewable energy sources

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Explain contribution and impact of renewable energy sources	Understand
CO2	Describe the features of power electronics and their role in renewable energy system	Understand
CO3	Design appropriate converter for renewable energy systems	Apply
CO4	Categorize various issues experienced during grid connection of wind generators	Analyze
CO5	Categorize various issues experienced during grid connection of PV systems	Analyze
CO6	Demonstrate the control aspects of converters used in wind generators and PV systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	L		L			L	L					L	L		
CO2	L	L	L		M	M	L		L		L	M	M	S	M
CO3	S	M	S	L					L		M			S	L
CO4		M	M	M	L	M	L	M	M	M		L	M	M	L
CO5		M	M	M							M			S	L
CO6	M	L	S	L	L		M	L	M		M	L	L		S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG

POWER CONVERTERS

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters

ANALYSIS OF WIND AND PV SYSTEMS

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

HYBRID RENEWABLE ENERGY SYSTEMS

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

TEXT BOOK

1. Haitham Abu-Rub, Mariusz Malinowski & Hamal Al Haddad, "Power Electronics for Renewable Energy Systems, Transportation and Industrial Applications", IEEE Press and John Wiley Publications, First Edition, 2014.
2. Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration (Green Energy and Technology), Sudipta Chakraborty, Marcelo G. Simões, William E. Kramer, Springer; 2013 edition, ISBN-10: 1447151038, ISBN-13: 978-1447151036

REFERENCES

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi

COURSE DESIGNERS

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17EEEC10	POWER QUALITY	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE:

This course imparts knowledge about various electrical power quality issues and their origin and addresses the effects of power quality problems on electrical power system. It also emphasis need for PQ monitoring and measurement.

PREREQUISITE :

NIL

COURSE OBJECTIVES

1	Describe various power quality problems.
2	Identify the root cause of power quality problems.
3	Explain the impact of PQ issues on various electrical components.
4	Interpret the need for PQ monitoring and measurement.
5	Illustrate the harmonics distortion in the given electrical drive.
6	Determine various power quality issues and their solutions in residential / commercial / industrial facilities.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain various power quality problems.	Understand
CO2: Discuss the root cause of power quality problems.	Understand
CO3: Explain the impact of PQ issues on various electrical components.	Understand
CO4: Discuss the need for PQ monitoring and measurement.	Understand
CO5: Compute the harmonics distortion in the given electrical drive.	Apply
CO6: Analyze various power quality issues and their solutions in residential / commercial / industrial facilities.	Analyze

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L									L				
CO2	M	L												L	
CO3	M	L					M							M	
CO4	M	L			L					M	M	L		S	L
CO5	S	M	L	L	M		M				S	L	L	M	L
CO6	S	S	M	M	M		M			M	S		L	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction

Power quality - Impact of PQ on end users, Need for PQ monitoring, Various PQ Problems

Voltage disturbances

Voltage dips, over voltages, short supply interruptions, voltage fluctuations and flicker - sources, effects, measurement and mitigation

Transients

Transient system model, examples of transient models and their response, power system transient model, types and causes of transients, lightning, other switching transients.

Voltage and Current Unbalance

Symmetrical components of currents and voltages, sources, effects, measurements and mitigation

Harmonics

Definition, odd and even harmonics, harmonic phase sequence, voltage and current harmonics, individual and total harmonic distortion, harmonic standards, sources, effects on various electrical components, measurements and mitigation, passive and active filters (Case Studies)

Power factor

Active and reactive power flow with nonlinear load, displacement and distortion power factor, power factor penalty, power factor improvement, applications of synchronous condensers and static VAR compensators, automatic power factor controller (Case Studies)

Grounding

Shock and fire hazards, essential of a grounded system, earth resistance tests, methods of grounding.

Solving power quality problems using CPD

Power quality measuring equipment-Smart power quality analyzers, Introduction to custom power devices (CPD) – STATCOM, DVR, UPQC.

Text Book

1. Sankaran C,"Power Quality", CRC Press special Indian edition 2009.

Reference Books

1. Angelo Baggini, "Handbook of Power Quality" John Wiley & Sons Ltd, 2008.
2. Roger .C. Dugan, Mark F.Mcgranaghan & H.Wayne Beaty," Electrical power system Quality" McGraw-Hill Newyork Second edition 2003.
3. Barry W.Kennedy, "Power Quality Primer", McGraw-Hill, New York, 2000.
4. Math H.J.Bollen, « Understanding Power Quality Problems : Voltage Sags and Interruptions », IEEE Press, New York, 2000.
5. Arrillaga.J, Watson.N.R and Chen.S, « Power System Quality Assessment », John Wiley & Sons Ltd., England, 2000
6. Bhim Singh, Ambrish Chandra and Kamal Al-Haddad: Power Quality: Problems and Mitigation Technique, Wiley Publications, 2015.
7. Ewald Fuchs Mohammad Masoum, "Power Quality in Power Systems and Electrical Machines" 2nd Edition, Academic Press, ISBN: 9780128007822, 2015.

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17EEEC11	POWER SYSTEM PLANNING AND RELIABILITY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To make students become familiar with power system operation and the various control actions to be implemented on the power system for reliability.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To introduce the students learn the objectives of power system.
2	To make the students learn the reliability stability analysis of generation in power system.
3	To make the students learn the reliability stability analysis of transmission in power system.
4	To familiarize the students with the planning of expansion of power system.
5	To introduce the students with the overview of planning of distribution system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the load forecasting , Load growth patterns and their importance in planning	Understand
CO2: Explain the reliability of iso and interconnected generation systems, reliability indices like LOLP and expected value of demand not served.	Understand
CO3: Explain the reliability indices like LOLP and expected value of demand not Served in transmission system	Understand
CO4: Solve the Capacitor placer problem in transmission system and radial distributions system.	Apply
CO5: Design the primary and secondary distribution systems	Create
CO6: Describe the planning of expansion of power system and distribution system	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	--	M	--	--	--	--	--	--	M	--	M	M
CO2	--	S	--	--	--	--	--	--	--	--	--	L	--	--	M
CO3	--	S	--	--	--	--	--	--	--	--	--	L	--	--	M
CO4	S	S	--	--	--	--	--	--	--	--	--	--	S	M	M
CO5	S	S	S	--	S	--	S	--	--	S	--	M	S	M	M
CO6	--	--	--	--	M	--	M	--	--	--	--	--	--	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

LOAD FORECASTING

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.

GENERATION SYSTEM RELIABILITY ANALYSIS

Probabilistic generation and load models- Determination of LOLP and expected value of demand not served –Determination of reliability of iso and interconnected generation systems.

TRANSMISSION SYSTEM RELIABILITY ANALYSIS

Deterministic contingency analysis-probabilistic load flow-Fuzzy load flow probabilistic transmission system reliability analysis-Determination of reliability indices like LOLP and expected value of demand not served.

EXPANSION PLANNING

Basic concepts on expansion planning-procedure followed for integrate transmission system planning, current practice in India-Capacitor placer problem in transmission system and radial distributions system.

DISTRIBUTION SYSTEM PLANNING OVERVIEW

Introduction, sub transmission lines and distribution substations-Design primary and secondary systems-distribution system protection and coordination of protective devices.

TEXT BOOKS

1.Roy Billinton and Allan Ronald, “Power System Reliability Evaluation, Gordon and Breach, Science Publishers,Inc.,May,1982.”
2.J.Endreny,”Reliability modeling in electric power systems” John Wiley & sons, Jan 1979.

REFERENCES

1. Proceeding of work shop on energy systems planning & manufacturing CI.
2. R.L .Sullivan, “ Power System Planning”,February 1977.
3. Turan Gonen, Electric power distribution system Engineering ‘McGraw Hill,1986

COURSE DESIGNERS

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17EEEC12	POWER SYSTEM TRANSIENTS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also to study propagation, reflection and refraction of these surges on the equipments their impact on the power system grid.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To study the generation of switching transients and their control using circuit – theoretical concept.
2	To study the mechanism of lighting strokes and the production of lighting surges.
3	To study the propagation, reflection and refraction of travelling waves.
4	To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.
5	To study the over voltages faults and switching surges on integrated system.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Describe the importance of transients in system planning.	Understand
CO2: Explain the switching and lightning transients.	Understand
CO3: Examine the mechanism of lighting strokes.	Analyze
CO4: Explain the importance of propagation, reflection and refraction of travelling waves.	Understand
CO5: Deduce the voltage transients caused by faults.	Analyze
CO6: Describe the concept of circuit breaker action, load rejection on integrated power System.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	--	S	--	--	--	--	--	--	M	S	S	--
CO2	S	S	S	--	S	--	--	--	--	--	--	M	S	S	--
CO3	S	L	--	--	--	--	--	--	--	--	--	L	L	--	--
CO4	L	--	--	--	--	--	--	--	--	--	--	L	M	--	--
CO5	S	S	S	--	S	--	M	--	--	--	--	S	S	S	--
CO6	S	--	--	--	S	--	--	--	--	--	--	--	L	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION AND SURVEY

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients – basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

SWITCHING TRANSIENTS

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

LIGHTNING TRANSIENTS

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

TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS

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

TRANSIENTS IN INTEGRATED POWER SYSTEM

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

TEXT BOOKS

1.Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Interscience, New York, 2nd edition, January 2010.
2.R.D.Begamudre, 'Extra High Voltage AC Transmission Engineering', New Academic Science Limited, 4th edition, March 2011.

REFERENCE BOOKS

1.M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, November 2008.

COURSE DESIGNERS

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17EEEC13	SPECIAL ELECTRICAL MACHINES	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE:

This course aims to impart in students, a good understanding of fundamental principles of different types of special machines. The course includes constructional details, operating principles, motor characteristics, microprocessor based controllers and applications of various types of special machines.

PREREQUISITE : 17EECC02 & 17EECC05 Electrical Machines – I & Electrical Machines – II.

COURSE OBJECTIVES

1	To understand the construction, principle of operation, torque equation, driver circuits & applications of Synchronous reluctance motors.
2	To study the construction, principle of operation, torque equation, driver circuits & applications of Stepper motors.
3	To understand the construction, principle of operation, torque equation, driver circuits & applications of Switched reluctance motors.
4	To study the construction, principle of operation, torque equation, driver circuits & applications of Permanent magnet synchronous motors.
5	To understand the construction, principle of operation, torque equation, driver circuits & applications of Permanent magnet brushless DC motors.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Illustrate the basic construction and operating principle of Synchronous Reluctance Motor, SRM, Stepper motor, PMSM and PMBLDC Motor	Understand
CO2: Explain the motor characteristics, power input and torque development in Synchronous Reluctance Motor, SRM, Stepper motor, PMSM and PMBLDC Motor.	Understand
CO3: Develop the drive systems and control schemes for Stepper motors, SRM,PMSM and PMBLDC Motor.	Apply
CO4: Select the suitable special purpose motor for the specific application	Apply
CO5: Explain the Microprocessor based control of Stepper motors, SRM,PMSM and PMBLDC Motor.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L									M				
CO2	M	L		L							M		L	L	
CO3	S	M	L	M	M		L		M	L	S			S	
CO4	S	M	L	L							M	L		M	
CO5	M	L		M	S		L		M		S	L		S	L

S- Strong; M-Medium; L-Low

SYLLABUS

Synchronous Reluctance Motors

Constructional features - Operating principles - Types - Axial and Radial flux motors - Reluctance torque-Torque equation - characteristics - Syncrel drive system - Phasor diagram-Applications.

Stepper motors

Constructional features - Principle of operation - Torque production in Variable Reluctance (VR) stepper motor - Hybrid motor - Multi stack configuration - Modes of excitations - Characteristics - Drive circuits - Closed loop control - Microprocessor control of stepping motors - Applications.

Switched Reluctance Motors

Constructional features - Principle of operation - Rotary and Linear SRMs - Torque equation - Modes of operation - Power converter circuits - Closed loop control of SRM drive - Microprocessor control of SRM drive -Sensor less control of SRM drive - Characteristics - Applications.

Permanent Magnet Synchronous Motors

Constructional features - Principle of operation - EMF and Torque equations - Armature reaction EMF - Synchronous Reactance - Sinewave motor with practical windings - Phasor diagram - Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements - Microprocessor based control of PMSM - Applications.

Permanent Magnet Brushless DC Motors

Constructional features - Principle of operation – Classifications – EMF and torque equations - Power controllers - Commutation in DC motors - mechanical and electronic commutators - Hall sensors - Optical sensors - Torque-speed characteristics - Magnetic circuit analysis - Sensorless control of BLDC motors - Applications.

TEXT BOOKS:

1. Bimal K.Bose, “Modern Power Electronics and AC Drives”, Prentice Hall, New Delhi, 2005.
2. Gopal K.Dubey, ”Fundamentals of Electrical Drives”, Narosa Publishing House Pvt.Ltd.,New Delhi, Second edition, 2015.

REFERENCE BOOKS:

1. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, Prentice Hall of India, 2009.
2. T.J.E.Miller ,”Brushless Permanent Magnet and Reluctance DC Motor Drives”, Clarendon Oxford Press, 1989.
3. T. Kenjo, “Stepping Motors and their Microprocessor Controls”, Clarendon Oxford Press, 1994.
4. K.Venkataratnam, “Special Electrical Machines”,University Press(India) Pvt.Ltd.,2009.
5. E. G. Janardanan, “Special Electrical Machines”, PHI Learning Private Limited, ISBN: 978-81-203-4880-6, Delhi, 2014.

COURSE DESIGNERS

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17EEEC14	WIND ENERGY CONVERSION SYSTEMS	Category	L	T	P	Credit
		EC(PPS)	3	0	0	3

PREAMBLE

To understand and familiarize the principle, Concepts of wind energy conversion system.

PREREQUISITE :

17EECC06 Power electronics

COURSE OBJECTIVES

1	To understand the components, various theories and dynamics of wind energy conversion systems.
2	To study the various types of wind turbines.
3	To study about the fixed speed systems in wind energy conversion systems.
4	To study the variable speed systems in wind energy conversion systems.
5	To introduce the grid connected renewable energy systems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Realize the basics of wind energy conversion systems	Understand
CO2: Comprehend various types of wind turbines in energy conversion systems	Understand
CO3: Understand the operations of various types of electrical machineries used for fixed speed systems.	Understand
CO4: Illustrate the generation of electrical power from variable speed systems.	Analyze
CO5: Acquire knowledge on grid connected wind farm.	apply
CO6: Design a standalone wind energy conversion system.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	M	S	S	L	-	-	L	-	M	-	M
CO2	S	L	-	-	M	S	S	L	-	-	L	-	L	-	L
CO3	S	L	L	-	S	S	S	L	-	-	L	-	M	L	L
CO4	S	M	L	-	S	S	L	L	-	-	M	-	M	-	-
CO5	S	M	L	L	S	S	S	L	-	-	M	--	L	-	-
CO6	S	M	L	L	L	L	M	L	L	L	S	L	S	L	M

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine

WIND TURBINES

HAWT-VAWT-Power developed-Thrust-Efficiency-Rotor selection-Rotor design considerations-Tip speed ratio-No. of Blades-Blade profile-Power Regulation-yaw control-Pitch angle control-stall control-Schemes for maximum power extraction.

FIXED SPEED SYSTEMS

Generating Systems- Constant speed constant frequency systems -Choice of Generators-Deciding factors-Synchronous Generator-Squirrel Cage Induction Generator- Model of Wind Speed- Model wind turbine rotor - Drive Train model-Generator model for Steady state and Transient stability analysis.

VARIABLE SPEED SYSTEMS

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- Variables in wind energy conversion systems – wind power density – power in a wind stream – wind turbine efficiency –Forces on the blades of a propeller- Variable speed generators modeling - Variable speed variable frequency schemes.

GRID CONNECTED SYSTEMS

Stand alone and Grid Connected WECS system- low-voltage ride through (LVRT), ramp rate limitations, and supply of ancillary services for frequency and voltage control, current practices and industry trends wind interconnection -Grid connection Issues-Machine side & Grid side controllers-WECS in various countries

TEXT BOOKS:

1. *S.Rao & B.B.Parulekar, "Energy Technology", 4th edition, Khanna publishers, 2005.*
2. *Wind energy Handbook, Edited by T. Burton, D. Sharpe, N. Jenkins and E. Bossanyi, John Wiley & Sons, 2001*

REFERENCE BOOKS:

1. *L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990*
2. *Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.*
3. *E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge,1976.*
4. *S.Heir "Grid Integration of WECS", Wiley 1998.*

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17EEEC15	POWER SYSTEM RESTRUCTURING AND DEREGULATION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To make students become familiar the overview of power system restructuring and deregulation .

PREREQUISITE : Power System Operation and Control(17EECC10)

COURSE OBJECTIVES

1	To study the overview of the restructured power system.
2	To study the Differentiate between the integrated power system and restructured power system.
3	To study the various models of deregulated power system.
4	To study the comparison of different methods in transmission pricing.
5	To study the overview of congestion management.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the overview of the restructured power system	Understand
CO2: Differentiate between the integrated power system and restructured power system	Understand
CO3: Explain the various models of deregulated power system	Understand
CO4: Examine the wholesale electricity market characteristics.	Analyze
CO5: Compare the different methods in transmission pricing	Analyze
CO6: Explain the overview of congestion management.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	S	-	-	S	-	-	-	-	-	-	-	-	L	-
CO2	-	S	-	-	-	-	-	-	-	-	-	-	-	M	-
CO3	S	S	-	-	-	-	-	-	-	-	-	-	S	-	-
CO4	-	-	-	-	-	-	-	M	S	S	S	-	-	-	S
CO5	-	-	-	-	-	-	-	M	-	M	S	-	-	-	S
CO6	S	S	-	-	-	-	-	-	-	-	-	-	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO DEREGULATION AND RESTRUCTURING

Gencos, transcos, discos, customers, ISO, Market operators. privatization, An overview of the restructured powersystem, difference between integrated power system and restructured power system, transmission open access,wheeling, Power systems operation – old Vs new, Key issues associated with the restructuring of ESIs, advantages of competitive system.

DEREGULATION OF POWER SECTOR

Separation of ownership and operation, Deregulated models – pool model, pool and bilateral trades model, multilateral trade model.

COMPETITIVE ELECTRICITY MARKET

Independent System Operator activities in pool market, wholesale electricity market characteristics, central auction,single auction power pool, double auction power pool, market clearing and pricing, Market Power and its MitigationTechniques, Bilateral trading, Ancillary services.

TRANSMISSION PRICING

Marginal pricing of Electricity, nodal pricing, zonal pricing, embedded cost, postage stamp method, contract pathmethod, boundary flow method, MW-mile method, MVA-mile method, comparison of different methods.

CONGESTION MANAGEMENT

Total Transfer Capability – Limitations – Margins – Available transfer capability (ATC) – Procedure – methodsto compute ATC – Static and Dynamic ATC – Bid, Zonal and Node Congestion Principles – Inter and Intra zonal congestion – Generation Rescheduling – Transmission congestion contracts.

TEXT BOOKS

1. *Loi Lei Loi, " Power System Restructuring and Deregulation – Trading, performance& information technology", John Wiley sons,2001.*
2. *Kankar Bhattarcharya, et,al., "Operation of restructured power systems", Kluwer academic publishers,2001.*

REFERENCE

1. *S. A. Khaparde and A. R. Abhyankar, "Restructured Power Systems", Narosa Publishing House, New Delhi, India, 2008.*
2. *S. C. Srivastava and S. N. Singh, "Operation and Management of Power system in Electricity Market", Narosa Publishing House,New Delhi, India, 2008.*
3. *M. Shahidehpour and M. Alomoush, "Restructuring Electrical Power Systems", Marcel Decker Inc., Scholarly Transaction Papersand Utility web sites, 2001.*

COURSE DESIGNERS

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17EEEC16	ELECTRIC VEHICLES	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

This course introduces the fundamental concepts, principles, design and analysis of hybrid, electric vehicles.

PREREQUISITE: 17EEES03 Basic Electrical & Electronics Engineering.

COURSE OBJECTIVES

1	To understand the basic concepts and dynamics of electric vehicles.
2	To familiarize and design of battery backup.
3	To analyze the characteristics of different types of DC & AC Motors.
4	To understand different types of power transmission configuration, clutch and braking.
5	To study about hybrid electric vehicles.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Describe the basic concepts of electric vehicles.	Understand
CO2: Design the propulsion system for electric vehicles.	Evaluate
CO3: Explain the construction, characteristics and application of batteries.	Analyze
CO4: Elucidate performance characteristics of DC&AC electrical machines.	Analyze
CO5: Design the drive train model for electric vehicles.	Evaluate
CO6: Describe about the various types and configuration of hybrid electric vehicle.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	M	-	L	L	-	-	-	L	S	-	-
CO2	S	M	S	L	M	S	L	M	M	L	M	S	S	S	L
CO3	S	L	-	-	M	L	-	-	-	L	L	-	S	M	-
CO4	S	L	-	-	M	L	-	-	-	L	L	-	S	M	-
CO5	S	M	S	L	M	S	L	M	M	M	M	S	S	S	L
CO6	S	L	-	-	M	L	L	L	-	-	-	L	S	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

ELECTRIC VEHICLES

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

DC & AC ELECTRICAL MACHINES

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

ELECTRIC VEHICLE DRIVE TRAIN

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

HYBRID ELECTRIC VEHICLES

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

TEXT BOOKS:

1. Iqbal Hussain, *"Electric & Hybrid Vehicles – Design Fundamentals"*, Second Edition, CRC Press,
2. *James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.*

REFERENCE BOOKS:

1. *Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles-Fundamentals", CRC Press, 2010.*
2. *Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000 .http://nptel.ac.in/courses/108103009*

COURSE DESIGNERS

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17EEEC17	**PHOTOVOLTAIC ENERGY CONVERSION**	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

First hand course on basics of a solar PV cell, its physics of operation, characteristics, energy conversion and PV cell assembly.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To Understand the concepts of Semiconductor physics related to solar PV cells
2	To Study the characteristics and parameters of a solar PV cells
3	To Understand various types of connections of solar cells and array
4	To study the concepts of energy conversion using solar cells and array
5	To understand the procedure and process involved in solar power module & assembly

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO 1	Explain the physical science behind the formation of a solar PV cell	Understand
CO 2	Predict the performance of a solar PV cell and array	understand
CO 3	Apply electrical circuit concepts for PV cells series & parallel	Apply
CO 4	Appraise the energy conversion from solar radiation to electricity	Understand
C0 5	Design the solar PV cell module assembly	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M		-	-	-	M	-	-	-	-	-	M	M	M
CO2	-	S	L	-	-	-		-	-	-	M	-	S	M	M
CO3	-	-	S	-	-	-	S	-	-	-	-	-	M	-	M
CO4	-	M		-	M	-	S	-	-	-	-	-	-	-	-
CO5	-	-		-	-	S	-	-	-	-	-	S	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

PROPERTIES OF SEMICONDUCTOR

Semiconductors: Crystals structures, atomic bonding, energy band diagram – direct & indirect band gap- p & n doping and carrier concentration - Hall effect in semiconductors – Intrinsic & extrinsic semiconductor - compound semiconductors – diffusion and drift of carriers, continuity equation – optical absorption – carrier recombination -Effect of temperature.

SOLAR PV CELL

PV Cell Characteristics and equivalent circuit – model of PV cell- Short circuit, open circuit and peak power parameters – data sheet study –cell efficiency – effect of temperature – temperature effect calculation –fill factor PV efficiency; optical losses; electrical losses, surface recombination velocity, quantum efficiency cell simulation

CONNECTION OF PV CELL

PV cells in series and parallel– load line – non identical cells in series and parallel – protection of PV cells in series – protection of PV cells in parallel – measuring I-V characteristics – simulation

ENERGY COLLECTION AND ATMOSPHERIC EFFECTS

Insolation and irradiance – variation of insolation with time of day – earth centric view point and declination – solar geometry –insolation on a horizontal flat plate – energy on a horizontal flat plate – sunrise and sun set hour angles. Energy on a titled flat plate – atmospheric effects – airmass – energy with atmospheric effects – clearness index

SOLAR CELL MODULE MATERIALS AND ASSEMBLY

PV modules: Module and Circuit Design - Identical and Non-identical Cells – Module Structuring and assembly - Environmental Protection - Thermal Considerations – Electrical Considerations and output conditioning - assembly materials – interconnects – crystalline and thin film modules - issues with solar PV modules, bypass diode and blocking diode – module testing and analysis.

TEXT BOOKS

1. Semiconductors for solar cells, H. J. Moller, Artech House Inc, MA, USA, 1993.
2. Fundamentals of Solar Cells: PV Solar Energy Conversion, Alan L Fahrenbruch and Richard H Bube ,Academic Press, New York , 1983
3. Solar Cells: Operating principles, Technology and Systems Applications, Martin Green, UNSW, Australia,1997.

REFERENCE BOOKS

1. *Solar Cells and their Applications, Larry D Partain (ed.), John Wiley and Sons, Inc, New York, 1995.*
2. *J. Nelson, The physics of solar cells, Imperial College Press, 2006.*
3. *Photovoltaic Materials, Richard H Bube, Imperial College Press, 1998*
4. Solar Cell Array Design Handbook, H S Rauschenbach, Van NostrandReinfold, 1997.

COURSE DESIGNERS

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17EEEC18	**RENEWABLE ENERGY TECHNOLOGY**	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

This course helpful for the students to enhance their knowledge in renewable sources and empower the students to understand the need of renewable source, utilization of techniques and its advantages. Energy is a vital input for the development and economic growth of a country. The growth for energy sector is critical for socio-economic development particularly for rural areas. Students will be exposed to the status of energy resources, its interaction with environment, different renewable energy sources technologies, different techniques and technologies for energy management and energy conservation along with the economic aspects of renewable energy based power generation. It is to provide specialist manpower to meet the challenges of the energy sector.

PREREQUISITE

- NIL

COURSE OBJECTIVES

1	To familiarize the student with the utilization methods of the renewable energy resources
2	To learn about PV Technology principles.
3	To learn economical and environmental merits of solar energy for variety applications.
4	To learn modern wind turbine control & monitoring.
5	To learn various power converters in the field of renewable energy technologies.
6	To study and Analyze different types of Power converters for Renewable energy conversion

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Understand the various PV technologies	Understand
CO2	Implement The PV technology to various applications.	Apply
CO3	Assess the control and monitoring systems	Analyse
CO4	Realize modern control methods of wind turbine	Understand
CO5	Analyze various power converters.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L			M	M			L		M	L		L
CO2	L		L	M	M			L	M		L	M	L	L	M
CO3	S	S	L		M	L			L	L			S	M	S
CO4	L	M		L	S		M		L			M	L	L	S
CO5	S	L	S	M	M					M	M			M	

S- Strong; M-Medium; L-Low

SYLLABUS

SOLAR THERMAL TECHNOLOGIES

Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying. Principle of working, types, design and operation of - Solar heating and cooling systems – Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

SPV SYSTEM DESIGN AND APPLICATIONS

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

DIRECT ROTOR COUPLED GENERATOR (MULTIPOLE) [VARIABLE SPEED VARIABLE FREQ.]

Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits

MODERN WIND TURBINE CONTROL & MONITORING SYSTEM

Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor &Blade), FACTS control & LVRT & New trends for new Grid Codes.

POWER CONVERTERS

Solar: Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

TEXT BOOK

1.Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, Taylor and Francis,2000

2.Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, 1996

3. Renewable Energy Sources and Emerging Technologies, Kothari, Prentice Hall India Learning Private Limited; 2 edition (2011), ISBN-10: 8120344707, ISBN-13: 978-8120344709

REFERENCES

1. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, Tata McGraw Hill, 2008.

2. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006

3.Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1983

4. John D Sorensen and Jens N Sorensen, Wind Energy Systems, Woodhead Publishing Ltd, 2011

5. Rashid .M. H “power electronics Hand book”, Academic press, 2001.

COURSE DESIGNERS

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17EEEC19	**DRIVE SYSTEM IN ELECTRIC TRACTION**	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

Preamble

Drive system in Electric Traction which provides the basic knowledge about traction drives with motor control, Comparison of the different drives system employed in electric traction. Methods of braking and controlling system. The drive which uses the electric power for moving forward, such type of drive is called an electric traction drive. One of the major applications of an electric drive is to transport men and materials from one place to another. It full fills the real time commercial applications of both Electrical and Mechanical field of drives and applications.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand theoretical concepts of electric drives.
2	To analyze the performance of DC motor drives.
3	To analyze the performance of induction motor drives for various operating conditions.
4	To study the traction system principle and its methodology
5	To understand the various traction system and its control.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO 1	Learn the basics of drives with characteristics and control	Understand
CO 2	Identify the conventional DC drive system. And its types	Remember
CO 3	Analyze the convertor control of drive system.	Analyze
CO 4	Understand various induction motor drives and its control.	Understand
C0 5	Find out the various methods of traction system and its comparison	Understand
C0 6	understand the various types of traction system and breaking systems	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L		L	M			L	S		S	M	L		S
CO2	S	S		M	L	L		M		L	M	L	L	M	
CO3	S			S	M						S		M		M
CO4	M	S	S		L			L		L	L	M		S	L
CO5	M	L	M		S		M				M		M		
CO6	S	L	M	L	L		S	M		L	S	S	L	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF ELECTRIC DRIVES

Basic concepts, Characteristics and operating modes of drive motors, Starting, braking and speed control of motors, Four quadrant drives, Nature and classification of load torque and associated controls used in process industries, Selection of motors and rating.

DC MOTOR DRIVES

Analysis of separately excited dc motor with continuous armature current and discontinuous armature current, Analysis of DC series motor drives, Comparative evaluation of phase angle control, Semi-converter operation of full converter, Single phase half controlled and fully controlled rectifier fed DC motors, Sequence control, Three phase half controlled and fully controlled rectifier fed DC motors, Dual converter with circulating and non-circulating current controlled drives, Closed loop control system of DC motor drives, Reversible drives, Analysis and performance characteristics of chopper fed DC motors, Motoring and braking operations, Multi phase chopper, Phase locked loop control of DC drive.

INDUCTION MOTOR DRIVES

Operation with unbalanced source voltages and unbalanced rotor impedances, Effect of time harmonics on the motor performance, Braking, Stator voltage control of induction motor, Variable voltage variable frequency (VVVF) operation, Voltage source inverter (VSI) fed induction motor drive, Static rotor resistance control, Slip power recovery systems, closed loop control of ac drives, Introduction to field oriented control of ac motors, Comparison of ac and dc drive.

ELECTRIC TRACTION- PRINCIPLE AND HISTORY

Systems of traction, The Indian Scenario of Electric traction, Present day State of art Electric traction as a Viable Transport Strategy for the 21st century, Advantages of Electric Traction over other systems of traction, Choice of traction system - Diesel- Electric or Electric. Mechanics of train movement, Speed - time curve for train movement, Requirement of reactive effort and T-N curve of a typical train load, Specific energy consumption & Factors affecting SEC Adhesion & Coefficient of adhesion, Suspension and mechanism of torque transmission, Concept of Weight Transfer & Effect of un-sprung mass and wheel diameter

TRACTION SYSTEMS AND MOTOR CONTROL

Methods of traction - track electrification - DC system - single phase and three-phase low frequency and high frequency system - composite system - kando system - comparison between AC and DC systems - Desirable characteristics of traction motors - suitability of series motor for traction - single phase series motor - repulsion motor - linear induction motor - Control of DC traction motors - series-parallel control - shunt and bridge transition - Rheostatic braking - regenerative braking of DC and three phase induction motors

Text Books

1. *K. Dubey, Fundamental of Electrical Drives, Narosa Publication.*
2. *H. Partab, Modern Electric Traction - DhanpatRai& Co, 2007.*

Reference Books

1.*S. K. Pillai, First Course on Electrical Drives, Wiley Eastern Limited.*

2.*V. Subramanyam, Electric Drives– concepts and applications, Tata McGraw Hill.*

3.*M.H.Rashid , "Power Electronics" , P.H.I. Edition*

4.*Gonzalo Abad, Power Electronics and Electric Drives for Traction Applications, John Wiley & Sons, 2016 ISBN : 1118954440, 9781118954447*

COURSE DESIGNERS

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7EEEC20	**MATHEMATICAL MODELLING AND SIMULATION**	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Introduce the students to study the fundamentals of computing and modeling software environments for electrical engineering. This Course contains Programming in numerical computing and modeling software environments for electrical engineering. No prior programming experience or knowledge of SCILAB is assumed, and the course is structured to allow thorough assimilation of ideas through hands-on examples and exercises.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study basic concepts of scientific programming using SCILAB.
2	To learn about the Basics of Program of SCILAB and related Mathematical Applications.
3	Analyze the concepts of Program of SCILAB.
4	To understand the different tools in SCILAB and ODE, DAE
5	To apply a software program to Electrical circuits and solve the simulation based solutions.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.	Understand
CO2	Understand the need for simulation/implementation for the verification of mathematical functions.	Understand and Analyze
CO3	Implement simple mathematical functions/equations in numerical computing environment such as SCILAB.	Analyze
CO4	Interpret and visualize simple mathematical functions and operations thereon using plots/display.	Create and Apply
CO5	Analyze the program for correctness and determine/ estimate/ predict the output and verify it under simulation environment using SCILAB tools	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M					L		L				L	L	M	
CO2	M		L					L		L		L	L	M	
CO3	S	M	L		L		L	L	M	M	L		M	L	L
CO4	S	M	M	L	M	M	M		S	M	M	M	M	L	M
CO5	S	S	L	M	M	L	S	L	M	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction to SCILAB – Constants – Data types – SCILAB Syntax – Data type related functions – Over loading.

GRAPHICAL ANALYSIS USING SCILAB

The media – global plot parameters – 2D and 3D plotting – examples – printing graphics and exporting to Latex.

SCILAB PROGRAMMING

Linear algebra – Polynomial and rational function manipulation – Sparse matrices – random numbers – cumulative distribution functions and their inverse – building interface programs – inter SCI – dynamic linking – static linking.

SCILAB TOOLS

Systems and control toolbox – improper systems – system operation – control tools classical control – state space control – model reduction – identification – linear matrix inequalities – integrating ODEs – integrating DAEs.

APPLICATIONS

Resistive circuits – inductive and capacitive circuits – transients – steady state analysis – logics circuits – electronic devices - DC machines

TEXT BOOK

1. Claude Gomez Engineering and Scientific Computing with SCILAB, Birkhauser publications

REFERENCES

1. ***Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications****A. Vande Wouwer, P. Saucez, C. V. Fernández 2014ISBN: 978-3319067896*
2. *SCILAB(a Free Software to Matlab), Er. HemaRamachandran and Dr. Achutsankar Nair, S. Chand Publishers, ISBN-10: 8121939704,2011*
3. *http://in.mathworks.com/*
4. *https://www.scilab.org/resources/documentation/tutorials*
5. ***http://www.scilab.org/***
6. *SCILAB: A Begineer's Approach, Anil Kumar Verma, Cengage Learning India Pvt. Ltd.; First edition (2018), ISBN-10: 9386858932, ISBN-13: 978-9386858931*

COURSE DESIGNERS

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17EEEC21	**NON CONVENTIONAL ENERGY SOURCES**	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Non Conventional sources of energy are generally renewable sources of energy. This type of energy sources include anything, which provides power that can be replenished with increasing demand for energy and with fast depleting conventional sources of energy such as coal, petroleum, “natural gas etc. The non- conventional sources of energy such as energy from sun, wind, biomass, tidal energy, geo thermal energy and even energy from waste material are gaining importance. This energy is abundant, renewable, pollution free and eco-friendly. It can also be more conveniently supplied to urban, rural and even remote areas. Thus, it is also capable of solving the twin problems of energy supply in a decentralized manner and helping in sustaining cleaner environment. It concerned with development of the national grid system will focus on those resources that have established themselves commercially and are cost effective for on grid applications

PREREQUISITE

- NIL

COURSE OBJECTIVES

1	To impart the knowledge of basics of different non conventional types of power generation & power plants
2	To understand the need and role of Non-Conventional Energy sources.
3	To learn economical and environmental merits of solar energy for variety applications.
4	To learn modern wind turbine control & monitoring.
5	To learn various power converters in the field of renewable energy technologies.
6	To study and analyse different types of Power converters for Renewable energy conversion

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Identify the different non conventional sources and the power generation techniques to generate electrical energy.	Understand
CO2	Explore the Solar Radiation, different Methods of Solar Energy Storage and its Applications.	Analyse
CO3	Familiarize the Winds energy as alternate form of energy and to know how it can be tapped	Understand
CO4	Explore the Geothermal Energy Resources and its methods.	Understand
CO5	Identify the Bio mass and Bio gas resources and its tapping technique	Analyze
CO6	Investigate the Tidal, Wave and OTEC Energy, Concepts of Thermo-Electric Generators and MHD Generators	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L		M	M		L	L		L			M			L
CO2	S	L	M	L	M	M	S	L	M	M	M	S	S	L	S
CO3		M	M	S	L	M	L			L	S		L	M	L
CO4	M	L				S		S	S	L	M	S			M
CO5		M	L	M	L	L	M	L	S	M	S	L	L	L	M
CO6	L						M		S	S		M	M		L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Statistics on conventional energy sources, Classification of Energy Resources, Definition Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. - Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources

SOLAR ENERGY CONCEPT

Introduction to Solar Energy - Radiation and its measurement, Solar Energy conversion and its types - Introduction to Solar Energy Collectors and Storage, Applications of Solar Energy: Solar Thermal Electric Conversion Systems, Solar Electric power Generation, Solar Photo-Voltaic, Solar Cell Principle, Semiconductor Junctions, Conversion efficiency and power output, Basic Photo Voltaic System for Power Generation, Stand-alone, Grid connected solar power satellite

WIND ENERGY CONCEPT

Introduction - Basic Principles of Wind energy conversion-The nature of wind- The power in the wind (No derivations) - Forces on the Blades (No derivations)-Site Selection considerations-Basic components of a wind energy conversion system (WECS)-Advantages & Limitations of WECS-Wind turbines (Wind mill)-Horizontal Axis wind mill-Vertical Axis wind mill-performance of wind mills-Environmental aspects - Determination of torque coefficient, Induction type generators

GEOTHERMAL AND BIOMASS ENERGY

Geothermal Sources - Hydro thermal Sources - a. Vapor dominated systems b. Liquid dominated systems -Prime movers for geothermal energy conversion - Biomass Introduction - Biomass conversion techniques-Biogas Generation-Factors affecting biogas Generation-Types of biogas plants- Advantages and disadvantages of biogas plants-urban waste to energy conversion - MSW incineration plant.

TIDAL AND OTEC ENERGY

Tidal Energy-Basic Principles of Tidal Power-Components of Tidal Power Plants- Schematic Layout of Tidal Power house-Advantages & Limitations of Tidal, Wave, OTEC energy - Difference between tidal and wave power generation, OTEC power plants, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC.

TEXT BOOK

1. *Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003*
2. *K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.*
3. Non Conventional Energy Resources, Shobh Nath. Singh, Pearson Education India, 2016, e – ISBN : 978933255906 - 6

REFERENCES

1. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 2004
2. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi, 2004.
3. Non – Conventional Energy Sources. Rai.

COURSE DESIGNERS

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1	P. LOGANATHAN	Assistant Professor	EEE / VMKVEC	loganathan@vmkvec.edu.in

17EEEC22	SCADA	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

Communication tool to analyze the power system date in real time applications.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the fundamentals of SCADA.
2	To analyze the SCADA Components.
3	To apprise the communication in SCADA.
4	To learn the Concept of Monitoring and Control unit of SCADA.
5	To analyze the application of SCADA in power System.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Estimate the system components of SCADA.	Evaluate
CO2. Outline the fundamentals of SCADA.	Analyze
CO3. Compare the various SCADA communication protocol.	Analyze
CO4. Illustrate the SCADA communication.	Apply
CO5. Explain the monitoring and control unit of SCADA.	Understand
CO6. Describe the applications of SCADA in power system .	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	L	M	M	--	--	--	--	--	--	L	L	M
CO2	M	--	--	--	M	M	--	--	--	--	--	--	L	--	L
CO3	L	M	--	--	M	M	--	L	--	S	--	L	M	L	M
CO4	L	M	--	--	M	M	--	--	--	S	--	L	M	L	M
CO5	L	--	--	--	L	M	--	--	--	--	--	L	M	M	M
CO6	S	S	--	--	L	M	--	--	--	--	--	L	L	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO SCADA

Evolution of SCADA, SCADA definitions, SCADA Functional requirements and Components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits.

SCADA SYSTEM COMPONENTS
Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA Control systems and Control panels.

SCADA COMMUNICATION
SCADA Communication requirements, Communication protocols: Past, Present and Future, Structure of a SCADA Communications Protocol, Comparison of various communication protocols, IEC61850 based communication architecture, Communication media like Fiber optic, PLCC etc. Interface provisions and communication extensions, synchronization with NCC, DCC.

SCADA MONITORING AND CONTROL
Online monitoring the event and alarm system, trends and reports, Blocking list, Event disturbance recording. Control function: Station control, bay control, breaker control and disconnector control.

SCADA APPLICATIONS IN POWER SYSTEM
Applications in Generation, Transmission and Distribution sector, Substation SCADA system Functional description, System specification, System selection such as Substation configuration, IEC61850 ring configuration, SAS cubicle concepts, gateway interoperability list, signal naming concept. System Installation, Testing and Commissioning

TEXT BOOKS:

1. *Stuart A. Boyer: SCADA-Supervisory Control and Data Acquisition, Instrument Society of America Publications,USA,2004*
2. *Gordon Clarke, Deon Reynders: Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes Publications, Oxford, UK,2004.*
3.

REFERENCES:

1. *William T. Shaw, Cybersecurity for SCADA systems, PennWell Books, 2006*
2. *David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003*
3. *Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric Power, PennWell 1999.*
4. *Dieter K. Hammer, Lonnie R.Welch, Dieter K. Hammer, "Engineering of Distributed Control Systems", Nova Science Publishers, USA, 1st Edition, 2001*

COURSE DESIGNERS

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2	L.CHITRA	Associate Professor	EEE/AVIT	chitra@avit.ac.in

17EEEC23	PRINCIPLES OF AUTOMATIC CONTROL	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

To provide the basics and fundamental concepts of automatic control systems. This will permit an engineer to exploit time domain and frequency domain tools to design and study automatic linear control systems

PREREQUISITE

2. NIL

COURSE OBJECTIVES

1	To provide a clear view of operational characteristics of sensors for its use in control system
2	To accustom with different industrial control system
3	To impart knowledge of pneumatic and hydraulic control actions
4	To acquire and apply knowledge of stability of control system

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Understand and apply the knowledge of different type of sensors in control system	Understand
CO2	Develop analogy for spring-mass damping system with electrical systems, thermal system, flow system	Apply
CO3	Understand and apply the knowledge of different types of pneumatic and hydraulic control actions	Understand
CO4	Understand and apply the knowledge of stability of control system	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	L	-	-	-	-	L	-	-	-	M	M	-	-
CO2	-	S	M	L	M	L	-	-	-	-	M	S	-	M	-
CO3	S	M	L	-	-	-	-	-	-	-	-	S	S	-	-
CO4	-	S	M	-	M	-	L	-	S	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit 1

Introduction Architecture industrial automation system, development trends in industrial automation, classification of existing systems, and functionality of industrial automation system. Relay and contactor logic, AC and DC relays and their role for load control. Power and Auxiliary contactors and their usage for load control.

Unit 2

Industrial Measurement System Characteristics Sensors and control logic, control using potential free output sensors Control using PO, PC, NO, NC type output sensor, 2W(2wire), 3W(3 wire), 4W(4wire) and 4WC sensors, Linear potentiometer Timer hardware, architecture, Controlling industrial system using timers Controlling industrial system using counters .Temperature Measurement, Pressure, Force and Torque Sensors, Motion Sensing, Flow Measurement, Signal Conditioning, Data Acquisition Systems.

Unit 3

Automatic Control Introduction, P-I-D Control, manual and auto PID Control Tuning, Feed forward Control Ratio Control, Time Delay Systems and Inverse Response Sy stems, Special Control Structures. Temperature controller hardware architecture.

Unit 4

PLC Introduction to Sequence Control, PLC, RLL (Relay Ladder Logic), Sequence Control. Scan Cycle, Simple RLL Programs, Sequence Control. More RLL Elements, RL L Syntax, A Structured Design Approach to Sequence, PLC Hardware Environment, Introduction To CNC Machines, Contour generation and Motion Control, Allen Bradley PLC and SIEMEN PLC.

Unit 5

Industrial Control Basics of hydraulics, Hydraulic components their functions and symbols Hydraulic actuators, Pumps and its operation, pump control, Hydraulic valves (Direction control, pressure and flow control), special valves, pressure gauges and switches, hydraulic logic circuits, Hydraulic Control System, Multiple pressure and speed operations, Industrial Hydraulic Circuit, Pneumatic systems and components Pneumatic Control Systems, compressor operation and control, air treatment.

Text books :

1. Butterworth-Heinemann ,Principles of Automatic control, , 2nd edition 1975
2. S N Verma Automatic Control Systems Khanna Publishers (2002)
3. Farid Golnaraghi, Benjamin C. Kuo, Automatic Control Systems, Wiley; Ninth edition (2014)

References:

1. Lingefeng Wang, Kay Chen Tan, "Modern Industrial Automation and Software Design" John Wiley & Sons Inc.

2. K. L.S. Sharma, “ Overview of Industrial Process Automation”, Elsevier

3. Kok Kiong “Drives and Control for Industrial Automation”, Springer

COURSE DESIGNERS

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2.	N.P. GOPINATH	Assistant Professor GR-II	EEE / AVIT	gopinathnp@avit.ac.in

17BMEC02	BIOTELEMETRY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study the overall concept of a Biotelemetry system and the concept of signal transmission.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To study the basic concepts and the principles used in a Telemetry system.
2	To study the building blocks used to make a electrical telemetry system.
3	To study the basic components of transmitting and receiving techniques.
4	To know about how optical fibers are used in signal transmission.
5	To understand the real time application in biotelemetry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Discuss about the basic information about Telemetry system.	Understand
CO2. Describe the knowledge about design of Electrical Telemetry Systems.	Understand
CO3. Demonstrate the different types of modulation techniques.	Apply
CO4. Analyze the implementation of optical fibers in telemetry system.	Analyze
CO5. Validate the healthcare system using Telemetry system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	--	--	--	--	--	--	--	--	L	--	M	M	--	--
CO2	M	--	--	--	--	--	--	--	--	L	--	M	S	M	--
CO3	S	--	L	L	--	L	--	--	M	M	--	S	M	M	--
CO4	S	M	L	L	M	M	L	M	M	S	--	S	M	M	S
CO5	S	S	M	L	M	S	M	M	S	S	--	S	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system- Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

ELECTRICAL TELEMETRY

Electrical Telemetry – Current Systems – Voltage Systems – Synchro Systems – Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

RADIO TELEMETRY SYSTEM

Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radiotelemetry system.

OPTICAL TELEMETRY SYSTEM

Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber– optic device development – Example of an optical telemetry System.

APPLICATION OF BIOTELEMETRY

Use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning, Data compression and Transfer, Capturing of medical signals, Analog to digital conversion, Video conferencing, Remote sensing, Rural primary setups, Referral and Super specialty centers, Societal medico legal aspects, Networking (local, national & global).

TEXT BOOKS

1. D.Patranabis, **"Telemetry principles"**, Tata Mcgraw Hill Publishers.
2. Marilyn J. Field, **"Telemedicine: A Guide to Assessing Telecommunications for Health Care"**, National Academic Press, 1996.

REFERENCE

1. Charles J. Amlaner, David W. Macdonald, **"A Handbook on Biotelemetry and Radio Tracking"**, Pergamon Press; 1st Edition (January 1, 1980).

COURSE DESIGNERS

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17BMCC03	BIOSENSORS AND TRANSDUCERS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course is designed to make the student acquire conceptual knowledge of the transducers and biological components used for the detection of an analyte. The relation between sensor concepts and biological concepts is highlighted. The principles of biosensors that are currently deployed in the clinical side are introduced.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To use the basic concepts of transducers, electrodes and its classification.
2	To discuss the various types of electrodes.
3	To determine the recording of biological components.
4	To employ the knowledge in electrochemical and optical biosensors.
5	To outline the various biological components using biosensors.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.	Describe the working principles of transducers.	Understand
CO2.	Explain the various types of electrodes.	Understand
CO3.	Utilize various FET sensors for recording of biological components.	Apply
CO4.	Distinguish various biosensors like electrochemical and optical biosensors.	Analyze
CO5.	Analyze the biological components using biosensors in various applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	--	M	--	M	--	--	L	--	--	M	--	--	--
CO2	M	L	--	M	--	M	--	--	L	--	--	M	--	--	--
CO3	S	M	L	S	--	S	M	M	M	--	--	M	M	--	--
CO4	S	S	L	S	--	S	M	M	S	--	--	M	--	--	M
CO5	S	S	L	S	--	S	M	M	S	--	--	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

TRANSDUCERS:

Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

BIO POTENTIAL ELECTRODES:

Half cell potential, Types of Electrodes –Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemical electrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

BIOSENSORS:

Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

APPLICATIONS OF BIOSENSORS:

Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

1. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw HILL, 1995.
2. Brain R Eggins, **"Biosensors: An Introduction",** John Wiley Publication, 1997.
3. Shakthi chatterjee, **"Biomedical Instrumentation"**, Cengage Learning, 2013.
4. John G Webster, **"Medical Instrumentation: Application and design"**, John Wiley Publications, 2001.

REFERENCES:

1. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & sons, 1991.
2. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).
3. Geddes and Baker, **"Principles of Applied Biomedical Instrumentation"**, 3rd Edition, John Wiley Publications, 2008.

COURSE DESIGNERS

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3	Dr.N.Babu	Professor	BME	babu@vmkvec.edu.in

17BMEC12	HOSPITAL MANAGEMENT	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE
To provide the knowledge of planning, designing and safety management in hospital services.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To obtain the knowledge about the basic planning and organization of hospitals.
2	To study about the clinical and administrative services.
3	To impart knowledge on designing of hospital services.
4	To study and analyze the safety management in hospitals.
5	To study and analyze the infection control in hospitals.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Summarize the importance of hospital in healthcare and planning of hospital design.	Understand
CO2. Examine the various clinical services needed in the hospital.	Apply
CO5. Outline the implementation of various infection control techniques.	Analyze
CO4. Recommend the supporting services needed to build the hospital and safety guidelines.	Evaluate
CO3. Build the idea about the hospital services design.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	--	--	--	--	--	L	--	--	--	M	M	M	M
CO2	S	M	L	L	--	--	-	M	M	--	--	M	--	M	M
CO3	S	M	M	M	M	M	M	M	M	--	--	M	S	M	M
CO4	S	M	S	M	S	M	M	S	M	S	L	M	S	S	S
CO5	S	S	S	S	S	M	S	S	M	S	M	M	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

PLANNING AND ORGANIZATION OF THE HOSPITALS
Roles of hospital in healthcare – hospital planning and design-outpatient services the nursing unit – intensive care Unit – nursing services – effective hospital management – directing and leading – controlling – financial management.

CLINICAL AND ADMINISTRATIVE SERVICES
Radiology and imaging services – laboratory services – operation theatre suite pharmacy – central sterile supply department – hospital infection – materials management – evaluation of hospital services.

DESIGNING OF HOSPITAL SERVICES
Engineering department – maintenance management – clinical engineering electrical system – air conditioning system – water supply and sanitary system centralized medical gas system – communication system – solid waste management and transportation.

DESIGNING SUPPORT SERVICES AND SAFETY MANAGEMENT
Admitting department – medical records department – food service department laundry and linen service housekeeping – Volunteer department – safety in hospital fire safety – Alarm system – disaster management.

HOSPITAL INFECTION CONTROL
Importance of infection control – hand hygiene – aseptic techniques – isolation precautions – disinfection and Sterilization – clinical laboratory standards to infection control – health care workers safety.

TEXT BOOKS:
1. Kunders G D, **"Biomechanics: Hospitals, facilities planning and management"**, Tata Mcgraw Hill, 2008.
2. Sakharkar B M, **"Principles of hospital administration and planning"**, Jaypee Brothers Medical Publishers Pvt. Limited, 2nd Edition, 2009.

REFERENCE:
1. Sanjiv Singh, Sakthikumar Gupta, Sunil Kant, "**Hospital infection control guidelines, principles and practice"**, Jaypee Brothers Medical Publishers Pvt Limited, 1st Edition, 2012.

COURSE DESIGNERS

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17ECSE12	MEDICAL ELECTRONICS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

PREAMBLE

The course is designed to make the student acquire conceptual knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance. The relation between electronic concepts and biological concepts is highlighted. The principles of electronic instrumentation that are currently deployed in the clinical side are introduced.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To learn the concept of Medical Sensors
2	To understand human body and parameters
3	To study the working of biomedical instruments
4	To study the imaging techniques
5	To understand the working of assist devices

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the human physiology.	Understand
CO2. Illustrate the working of biomedical equipments.	Apply
CO3. Apply Electronic Principles for recording and Monitoring Bio Signals	Apply
CO4. Distinguish diagnostic equipments from therapeutic equipments	Analyze
CO5. Examine the internal organs through imaging	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	-	-	M	-	-	-	-	-	-	M	-	-	-
CO2	S	S	M	-	M	-	-	M	-	-	-	M	S	-	-
CO3	S	M	M	-	M	-	-	M	-	-	-	M	M	M	-
CO4	S	S	S	-	M	-	-	M	-	-	-	M	M	M	M
CO5	S	S	S	-	M	-	-	M	-	-	-	M	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

PHYSIOLOGY AND TRANSDUCERS:

Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, Neurons – Synapse, Transmitters and Neural Communication, Cardiovascular system, respiratory system, Basic components of a bio-medical system , Transducers - Ultrasonic transducers, Temperature measurements - Fiber optic temperature sensors.

ELECTRO – PHYSIOLOGICAL MEASUREMENTS:

Electrodes, Limb electrodes, Floating electrodes, pregelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier, ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms.

NON –ELECTRICAL PARAMETER MEASUREMENTS:

Measurement of blood pressure, Cardiac output, Heart rate, Heart sound, Pulmonary function measurements, Spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers: pH of blood, Measurement of blood pCO_2, pO_2, finger-tip oxymeter, ESR, GSR measurements.

MEDICAL IMAGING AND DIAGNOSTICS:

Radio graphic and fluoroscopic techniques, Computer tomography, MRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring, Introduction to Biometric systems.

ASSISTING AND THERAPEUTIC EQUIPMENTS:

Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, Heart –Lung machine, Lasers, Audio meters, Dialysers, Lithotripsy, Electro Surgery.

TEXT BOOKS:

1. R.S.Khandpur, Hand Book of Bio-Medical instrumentation, Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, Bio-Medical Instrumentation and Measurements, II edition, Pearson Education, 2002.

REFERENCE BOOKS:

1. Joseph J. Carr, John M. Brown, Introduction to Biomedical Equipment Technology, Fourth Edition, Pearson.
2. Shakti Chatterjee, Aubert Miller, Bio-Medical Instrumentation Systems, Cengage Learning, 2010.
3. C.Rajarao and S.K. Guha, Principles of Medical Electronics and Bio-medical Instrumentation, Universities press (India) Ltd, Orient Longman ltd, 2000

COURSE DESIGNERS

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17BMCC10	MEDICAL IMAGE PROCESSING AND ANALYSIS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To learn the fundamental concepts of medical image acquisition and understand how to apply the image processing techniques for various medical images.

PREREQUISITE: 17BMCC08 - BIOMEDICAL SIGNAL PROCESSING

COURSE OBJECTIVES

1	To learn the image fundamentals and mathematical transforms necessary for image processing.
2	To study the various image enhancement techniques.
3	To study about the various segmentation techniques applied to Medical Images.
4	To gain knowledge about the basic concepts of image compression procedures.
5	To apply various image restoration procedures in Medical images.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Summarize the general terminology of digital image processing.	Understanding
CO2. Examine the need for image transforms and their types both in spatial and frequency domain.	Apply
CO3. Classify different types of image segmentation and apply restoration techniques.	Analyze
CO4. Analyze the image compression models and image compression techniques.	Analyze
CO5. Illustrate various methodologies for image segmentation in medical imaging.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	--	--	M	--	--	--	--	--	--	M	M	--	--
CO2	S	S	M	M	S	M	--	--	S	--	--	S	M	M	--
CO3	S	S	M	M	S	M	--	--	S	--	--	S	M	S	--
CO4	S	S	M	M	S	M	--	--	S	--	--	S	M	S	--
CO5	S	S	M	M	S	M	--	M	S	--	--	S	M	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

DIGITAL IMAGE FUNDAMENTALS
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.

IMAGE ENHANCEMENT
Basic gray level transformation, Histogram processing, Smoothening by spatial filters – Sharpening by spatial filters, Smoothening- frequency domain filters, Sharpening - frequency domain filters, Color image Processing- color models – Pseudo color image processing – Color Image Transformation – Smoothening – Sharpening.

IMAGE SEGMENTATION AND OBJECT RECOGNITION
Edge detection- Marr Hidreth edge detector - Canny edge detector, Thresholding foundation – Basic global thresholding – Basic Adaptive thresholding, Region Based segmentation, Watershed segmentation algorithm, Patterns and pattern classes, Recognition based on decision theoretic methods – matching, Optimum statistical classifiers.

IMAGE COMPRESSION
Introduction – Principle of compression – Types of compression – Run length Encoding – Huffman Coding – Modified Huffman Coding – Modified READ – LZW – Arithmetic Coding – JPEG – Other State-of-the-Art Image Compression – Image Compression Standard File Formats.

IMAGE RESTORATION AND RECONSTRUCTION OF MEDICAL IMAGES
Image degradation models, Algebraic approach to restoration, inverse filtering, Least mean square filter, Image reconstruction from projections – Radon transforms - Filter back projection algorithm – Fourier reconstruction of MRI Images.

TEXT BOOKS:
1. Rafael C, Gonzalez and Richard E Woods, **"Digital Image Processing"**, Pearson Education Asia, 3rd Edition, 2007.
2. Anil K Jain, **"Fundamentals of Digital Image Processing"**, Prentice Hall of India, 2nd Edition, 1997.

REFERENCES:
1. William K Pratt, **"Digital Image Processing"**, John Wiley, 4th Edition, 2007.
2. Albert Macouski, **"Medical Imaging systems"**, Prentice Hall, New Jersey, 2nd Edition, 1997.

COURSE DESIGNERS

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17BMSE16	WEARABLE TECHNOLOGY	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE
This course makes the students to understand the fundamentals and applications of the wearable technology.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the fundamentals of sensors and wearable technology.
2	To ascertain the design and integration of the smart textiles.
3	To understand the electronic textiles.
4	T endeavor various sensor in sports wearable application.
5	To understand the cloud storage of wearable devices.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO7. Discuss the fundamentals of sensor and wearable technology.	Understand
CO8. Illustrate the electronic textiles and its applications.	Apply
CO9. Analyze the sensor for different wearable applications.	Analyze
CO10. Compare the various data storage of wearable systems.	Evaluate
CO11. Design of smart clothing.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	--	--	--	--	--	--	L	--	--	S	M	--	--
CO2	S	M	L	L	--	--	--	--	M	--	--	S	S	M	--
CO3	S	M	M	M	S	M	L	--	M	--	--	S	S	M	M
CO4	S	S	S	S	S	S	M	M	S	S	M	S	S	S	--
CO5	S	S	S	S	S	S	M	M	S	S	S	S	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF SENSORS AND WEARABLE TECHNOLOGY
Introduction to sensors – Sensor Physical Properties – Electric (Resistive, Capacitive and Inductive) – Piezoelectric – Optic – Photo elastic - Thermoelectric – Electrochemical.
Wearable computers – Wearable Electronics – Intelligent Clothing – Industry on wearable technology – Current Trends – Market Forecast.

SMART CLOTHING
Introduction – Design of Smart Cloths – 2D Design for smart wearables – Textile Development – 3D Design for smart wearables – Construction of smart wearables – Integration – Prototype Development.

ELECTRONIC TEXTILES
Conductive Fibers for textiles – Conductive for Polymers textiles – Carbon Nanotubes yarns – Textile and Electronics Integration - Embroidered Antenna – Electronic textiles for Military Applications.

SENSOR FOR WEARABLE APPLICATIONS
Load and Pressure Measurement sensor – Sports Applications – Inertial Sensor – Sports Application – Optical Sensor – Sports Application – Angle & Displacement Sensor – Sports Application.

DATA STORAGE FOR WEARABLE TECHNOLOGY
Introduction – Storage in Consumer wearable - Cloud storage – Remote Cloud – Sensor Cloud – Cloudlet - Cloud storage Architecture – Confidential disk and Cloud storage with encryption – Two-layer confidential storage.

TEXT BOOKS:

1. *Patrick F. Dunn,* ***"Fundamentals of Sensors for Engineering and Science"****, CRC Press, Taylor & Francis.*
2. *Jane McCann, David Bryson,* ***"Smart Clothes and Wearable Technology"****, CRC Press, Woodhead Publishing Ltd.*

REFERENCES:

1. *Daniel A. James, Nicola Petrone,* ***"Sensors and Wearable Technologies in Sport: Technologies, Trends and Approaches for Implementation"****.*
2. *Marrington, Andrew, Kerr, Don,* ***"Management Association, Information Resources Managing Security Issues and the Hidden Dangers of Wearable Technologies"****.*
3. *Tilak Dias,* ***"Electronic Textiles: Smart Fabrics and Wearable Technology"****, Elsevier, Woodhead Publishing.*

COURSE DESIGNERS

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17BMCC82	BIOMEDICAL INSTRUMENTATION LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The curriculum of biomedical instrumentation lab is concerned to enable the students to know and operate the various biomedical instruments for measuring and diagnosing biological signals.

PRERQUISITE : NIL

COURSE OBJECTIVES

1	Design of amplifiers for biological signals.
2	Recording and analysis of bio signals.
3	Measurement of PH.
4	Study and measurement of blood pressure.
5	Measurement of galvanic skin resistance.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Design operational amplifier for inverting and non-inverting mode.	Create
CO2. Record and analyze EEG, ECG, EMG signals.	Analyze
CO3. Measure of PH value of a given solution.	Evaluate
CO4. Measure blood pressure non-invasively.	Evaluate
CO5. Design Filters for bio signals.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	--	M	--	--	S	--	--	S	M	--	--
CO2	S	S	M	M	S	M	--	--	S	--	--	S	M	M	M
CO3	S	S	S	M	--	M	--	--	S	--	--	S	--	--	M
CO4	S	S	S	M	--	M	--	--	S	--	--	S	--	--	M
CO5	S	S	S	S	--	M	--	--	S	--	--	S	M	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

List of Experiments

1. Blood pressure measurement using sphygmomanometer
2. Design of instrumentation amplifier
3. Measurement PH using PH meter
4. Galvanic Skin resistance measurement
5. Recording of ECG using ECG simulator
6. Recording of EEG using EEG simulator
7. Recording of EMG using EMG simulator
8. Optical Isolation Amplifier
9. Study of Phono Cardiogram (PCG)
10. Study of Types of electrodes

REFERENCES:

Department Lab Manual

COURSE DESIGNERS

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17ECSE13	BIOMEDICAL IMAGE PROCESSING LAB	Category	L	T	P	Credit
		EC(SE)	0	0	4	2

PREAMBLE

The purpose of learning this course on medical image processing Lab for biomedical engineering students is to acquire the fundamental concepts of image acquisition and understand how to apply the image processing techniques for various medical images.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	Understand the image fundamentals and mathematical transforms necessary for image processing.
2	**Describe the various image enhancement and image restoration techniques.**
3	**Apply various image segmentation methods and analysis in medical images.**
4	Illustrate the basic concepts of wavelets and image compression techniques.
5	**Explain the different types of reconstruction techniques applied to various medical Images.**

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Illustrate the basic issues and the scope (or principal applications) of image processing, and the roles of image processing and systems in a variety of applications	Apply
CO2. Apply image enhancement techniques.	Apply
CO3. Examine Image segmentation and image compression techniques.	Apply
CO4. Outline the image processing tasks with a high level of proficiency via software and hardware systems	Analyze
CO5. Develop and analyze Image processing algorithms in practical applications/case studies.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	--	L	--	--	--	--	--	--	--	M	S	-	-
CO2	S	M	L	L	M	--	--	--	M	--	--	M	M	-	-
CO3	S	M	L	L	M	--	--	--	M	--	--	M	M	-	-
CO4	S	S	M	M	S	--	--	--	S	--	--	S	-	S	-
CO5	S	S	M	M	S	--	--	--	S	--	--	S	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. *Basic operations on images*
2. *Gray level transformation and histogram processing*
3. *Image smoothening and image sharpening using suitable filters*
4. *Edge detection techniques*
5. *Histogram Processing and Basic Thresholding functions*
6. *Image segmentation using morphological operations*
7. *Image Linear Filtering and Transforms*
8. *Image Restoration techniques*
9. *Image compression techniques*

REFERENCES:

1. *Albert Macouski, "Medical Imaging systems", Prentice Hall, New Jersey, 2nd Edition, 1997.*
2. *Medical image processing lab manual.*

COURSE DESIGNERS

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1	Ms.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in
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17ECSE14	BIOMEDICAL SIGNAL PROCESSING LAB	Category	L	T	P	Credit
		EC(SE)	0	0	4	2

PREAMBLE

This laboratory introduces the different signal processing techniques used for analyzing Biomedical signals using MATLAB

PRERQUISITE – Nil

COURSE OBJECTIVES

1	Developing advanced signal processing and estimation methods for analyzing and understanding biomedical signals.
2	**Advancing our knowledge of pathophysiology through the investigation of behavior that manifests in physiologic signals.**
3	**Providing opportunities for student participation in rigorous research methodology and the dissemination of knowledge.**
4	The students will be motivated to apply signal processing to various areas such as image processing, biomedical signal processing, array signal processing etc.
5	**Contributing to regional and national biomedical research.**

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Examine the most important bioelectrical measurement methods: The ECG, the EEG and the EMG, in relation to normal and pathological conditions.	Apply
CO2. Apply and evaluate different methods for signal processing of the ECG, the EEG and the EMG, with respect to time- and frequency domain analysis.	Apply
CO3. Illustrate the artifact removal & signal extraction.	Apply
CO4. Outline bioelectricity in the heart and in the central and in peripheral nervous system.	Analyze
CO5. Analyze and evaluate physical, electrical and mathematical models for the origin of bioelectrical signals in the cell, and their conduction in nerves and in tissue	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	L	--	--	--	--	M	--	--	S	S	M	-
CO2	S	S	M	L	--	--	--	--	M	--	--	S	S	M	-
CO3	S	M	L	--	--	--	--	--	M	--	--	M	M	-	-
CO4	S	S	S	M	S	--	--	M	S	--	--	S	-	-	-
CO5	S	S	S	M	M	--	--	M	S	--	--	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

10. *Representation of basic signals.*
11. *Convolution & Correlation*
12. *To write and execute programs for image arithmetic operations.*
13. *To understand various image noise models and to write programs for image restoration*
14. *Analysis of EEG waveform*
15. *Analysis of EMG Signal*
16. *Processing of bio-signals using adaptive filters*
17. *Image processing for contrast enhancement and sharpening the edges*
18. *Data Compressions of bio-signals (ECG, EEG, EMG etc.) using DCT and wavelet transforms.*
19. *To write and execute program for FFT & IFFT.*

REFERENCES:

3. *Kayvan Najarian, Robert Splinter, "Biomedical Signal and Image Processing", CRC Press, Second Edition, 2012.*
4. *Biomedical signal processing lab manual.*

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17ECSE15	DATA ACQUISITION LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

The data acquisition plays a significant role all the fields of Engineering and Technology. This course will introduce students about computer based instrumentation techniques and an exposure to real time applications.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To enable the student to do measurements of various real time parameters
2	The student is enabled with the capacity to handle various guages
3	The student is enabled to produce pulse and measure its parameters
4	To handle the counters of various types
5	The student is exposed to hardware of various gauges

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand the working of Gauges	Understand
CO2. Apply the knowledge of gauges to take measurements	Apply
CO3. Analyze the pulse characteristics	Analyze
CO4. Analyze the various types of measurements	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	L	M	-	-	-	M	-	-	-	M	-	-
CO2	S	M	L	-	-	-	-	-	M	-	-	-	M	M	-
CO3	M	S	S	-	-	L	-	-	M	-	-	-	-	-	-
CO4	S	S	S	M	M	-	-	M	S	-	-	L	-	M	M

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. Measuring Temperature with RTDs
2. Measuring Pressure with Strain Gauges
3. Generating a Single Square Pulse
4. Generating a Pulse Train (A) Generating a Continuous Pulse Train (B) Generating a Finite Pulse Train
5. Measuring a Pulse Width
6. Connecting Counters to Measure Frequency and Period
7. Measuring the Frequency and Period of Low Frequency Signals
8. Measuring the Frequency and Period of High Frequency Signals
9. Counting Events or Elapsed Time

REFERENCE

1. Data Acquisition Lab Manual

COURSE DESIGNERS

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17EESE01	POWER ELECTRONICS IN POWER SYSTEMS	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBLE

The usage of power electronics in day to day life has increased in recent years. It is important for student to understand the fundamental principles behind all these converters. This course covers characteristics of semiconductor devices, ac/dc, dc/dc, ac/ac and dc/ac converters. The importance of using pulse width modulated techniques to obtain high quality power supply (dc/ac converter) is also discussed in detail in this course.

PREREQUISITE:NIL

COURSE OBJECTIVES

1	To Study about the basic concept of different types of power electronics devices.
2	To Study about the converters used in R, RL and RLE loads.
3	To Study about the voltage and current sources inverters.
4	To Understand the concept of static reactive power compensation in FACTS Technology.
5	To Study about the basics of power quality.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: The principle operate of the power semiconductor devices and find its ratings to their applications	Apply
CO2: Relate a single phase and three phase AC-DC phase controlled converters.	Apply
CO3: Analyze the performance factors of phase controlled converters.	Analyze
CO4: Compare the various types of AC voltage controllers and cyclo converter.	Analyze
CO5: Design Power Electronics devices in Renewable Energy Conversion and mitigations of power quality issues .	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	S	L	-	M	-	M	S	-	-	-	-	M	-
CO2	S	-	M	-	-	M	-	M	S	-	-	-	S	L	-
CO3	M	L	S	M	L	M	L	M	S	-	-	-	S	M	-
CO4	M	-	S	L	-	M	-	M	S	-	-	-	L	M	-
CO5	M	-	-	L	-	-	-	L	S	L	L	-	L	M	-

S- Strong; M-Medium; L-Low

INTRODUCTION

Basic Concept of Power Electronics, Different types of Power Electronic Devices – Diodes, Transistors and SCR, MOSFET, IGBT and GTO's.

AC TO DC CONVERTERS

Single Phase and three phase bridge rectifiers, half controlled and Fully Controlled Converters with R, RL, AND RLE loads. Free Wheeling Diodes, Dual Converter, Sequence Control of Converters – inverter operation , Input Harmonics and Out put Ripple ,Smoothing Inductance – Power Factor Improvement effect of source impedance, Overlap, Inverter limit.

DC TO AC CONVERTERS

General Topology of single Phase and three phase voltage source and current source inverters- Need for feedback diodes in anti parallel with switches – Multi Quadrant Chopper viewed as a single phase inverter-Configuration of Single phase voltage source inverter: Half and Full bridge, Selection of Switching Frequency and Switching Device. Voltage Control and PWM strategies.

STATIC REACTIVE POWER COMPENSATION

Shunt Reactive Power Compensation – Fixed Capacitor Banks, Switched Capacitors, Static Reactor Compensator, Thyristor Controlled Shunt Reactors (TCR) – Thyristor Controlled Transformer - FACTS Technology-Applications of static thyristor

Controlled Shunt Compensators for load compensation ,Static Var Systems for Voltage Control, Power Factor Control and Harmonic Control of Converter Fed Systems.

POWER QUALITY

Power Quality – Terms and Definitions – Transients – Impulsive and Oscillatory Transients –Harmonic Distortion – Harmonic Indices – Total Harmonic Distortion – Total Demand Distortion- Locating Harmonic Sources Harmonic s from commercial and industrial Loads –Devices for Controlling Harmonics Passive and Active Filters -Harmonic Filter Design-

Total hours = 45

REFERENCES

1. N.Mohan,T.M.Undeland and W.P.Robbins, Power Electronics : Converter, Applications and Design , John Wiley and Sons , 1989.
2. M.H.Rashid, Power Electronics, Prentice Hall of India, 1994.
3. B.K.Bose ,Power Electronics and A.C. Drives , Prentice Hall ,1986.
4. Roger C.Dugan , Mark .F. Mc Granaghan, Surya Santaso, H.Wayne Beaty, “Electrical Power Systems Quality”, Second Edition, Mc Graw Hill, 2002.
5. T.J.E. Miller, Static Reactive Power Compensation, John Wiley and Sons, Newyork, 1982.
6. Mohan Mathur.R., Rajiv.K.Varma, “Thyristor Based FACTS controllers for Electrical Transmission Systems”, IEEE press .1999.
7. Andrzej M. Trzynadlowski, “Introduction to Modern Power Electronics”, 2nd Edition, Wiley India Pvt Ltd, New Delhi, 2011.
8. Roger C Dugan, Mark F F Mcgranaghan, Surya Santoso & H.Wayne Beaty, “Electrical Power System Quality”, 3rd Edition, McGraw Hill, 2012.

COURSE DESIGNERS

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17EESE02	INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBLE

To study about the industrial power system analysis and design.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To study the basic principles, construction motor starting studies.
2	To understand the power factor correction studies Over Voltages-Switching Surge Analysis-Back-to-Back Switching.
3	To study the Harmonic Sources-System Response to Harmonics-System.
4	To understand Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis
5	To study improving the Performance of the Grounding Grids.

COURSE OUTCOMES

On the successful completion of the course, students will be able to	
CO1: Describe the Operating Principles of Various Motor Starting with Limited	Understand
CO2: Compare the studies of power factor correction Switching Surge Analysis-Back- to-Back Switching.	Analyze
CO3: identify the harmonic analysis of System Response to Harmonics-System Model for Computer-Aided Analysis	Analyze
CO4: Measure the flicker criteria-data for flicker Analysis.	Evaluate
CO5: Design ground grid calculations-Computer-Aided Analysis.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	S	L	M	M	-	M	S	-	L	-	M	M	-
CO2	M	M	M		L	M	-	M	S	-	M	-	M	S	L
CO3	M	S	S	M	M	M	-	M	S	-	M	-	L	L	L
CO4	S	S	S	L	-	M	-	M	S	-	M	-	M	M	-
CO5	M	M	-	L	-		-		S	-	L	-	M	M	-

S- Strong; M-Medium; L-Low

MOTOR STARTING STUDIES

Introduction-Evaluation Criteria-Starting Methods-System Data-Voltage Drop Calculations-Calculation of Acceleration time-Motor Starting with Limited-Capacity Generators-Computer-Aided Analysis-Conclusions.

POWER FACTOR CORRECTION STUDIES

Introduction-System Description and Modeling-Acceptance Criteria-Frequency Scan Analysis-Voltage Magnification Analysis-Sustained Over voltages-Switching Surge Analysis-Back-to-Back Switching-Summary and Conclusions.

HARMONIC ANALYSIS

Harmonic Sources-System Response to Harmonics-System Model for Computer-Aided Analysis-Acceptance Criteria-Harmonic Filters-Harmonic Evaluation-Case Study-Summary and Conclusions.

FLICKER ANALYSIS

Sources of Flicker-Flicker Analysis-Flicker Criteria-Data for Flicker analysis- Case Study-Arc Furnace Load-Minimizing the Flicker Effects-Summary.

GROUND GRID ANALYSIS

Introduction-Acceptance Criteria-Ground Grid Calculations-Computer-Aided Analysis - Improving the Performance of the Grounding Grids-Conclusions.

Total Hours = 45

REFERENCES

1.Ramasamy Natarajan, "Computer-Aided Power System Analysis", Marcel Dekker Inc., 2002.

2. Power System Analysis and Design, Fifth Edition, SIJ. Duncan Glover ,MulukutlaS. Sarma, and Thomas. Over bye Publisher, Global Engineering: Christopher M. Shortt 2012,

3. Power System Analysis and Design, SI Edition, 6th Edition J. Duncan Glover, Thomas Over bye, Mulukutla S. Sarma
Published: © 2017 Print ISBN: 9781305636187

COURSE DESIGNERS

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17EESE03	ARTIFICIAL INTELLIGENCE APPLICATION TO POWER SYSTEMS	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBL

To Study about the Artificial Intelligence application to Power Systems.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To Understand about the Introduction of Neural networks.
2	To Understand about the Application of Neural networks to Power System
3	To study the introduction to fuzzy logic.
4	To under stand applications to power systems.
5	To study genetic algorithm and its applications to power systems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1:Describe the Basics of ANN-Perceptron-Delta learning rule and Algorithm	Understand
CO2: Relate the application of neural networks to power system problems.	Apply
CO3:Analysis the various types of fuzzy logic and their working proramme for various application.	Analyze
CO4: Select to develop fuzzy set theory for various model of power system control	Evaluate
CO5: Design the basic idea genetic algorithm .	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	S	L	-	M	-	M	S	-	-	M	M	L	-
CO2	S	M	M		-	M	-	M	S	-	-	-	M	L	-
CO3	M	M	S	M	-	M	-	M	S	-	-	M	M	L	-
CO4	M	M	S	L	-	M	-	M	S	-	-	-	L	M	-
CO5	M	S	-	L	-	-	-	-	S	-	-	-	L	M	-

S- Strong; M-Medium; L-Low

INTRODUCTION TO NEURAL NETWORKS

Basics of ANN-Perceptron-Delta learning rule –Back Propagation Algorithm-Multilayer Feed forward network-Memory models-Bi-directional associative memory-Hopfield network

APPLICATIONS TO POWER SYSTEM PROBLEMS

Application of Neural Networks to load forecasting, Contingency Analysis-VAR control, Economic Load Dispatch.

INTRODUCTION TO FUZZY LOGIC

Crispness-Vagueness-Fuzziness-Uncertainty-Fuzzy set theory Fuzzy sets-Fuzzy set operations-fuzzy measures-fuzzy relations-fuzzy function. Structure of fuzzy logic controller- fuzzification models-data base-rule base-inference engine defuzzification module.

APPLICATIONS TO POWER SYSTEMS

Decision making in Power system Control through fuzzy set theory-Use of fuzzy set models of LP in Power systems scheduling problems-Fuzzy logic based power system stabilizer.

GENETIC ALGORITHM AND ITS APPLICATIONS TO POWER SYSTEMS

Introduction – Simple Genetic Algorithm – Reproduction,. Crossover, Mutation, Advanced Operators in Genetic Search – Applications to voltage Control and Stability Studies.

TEXT BOOKS:

1. Laurence Fausett, "Fundamentals of Neural Networks", Prentice Hall, Englewood Cliffs, N.J., 1992

2. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 2000.

REFERENCES

5. James.A.Freeman and B.M.Skapura “Neural Networks, Algorithms Applications and Programming techniques”- Addison Wesley,1990.
6. George Klir and Tina Folger,.A., “Fuzzy sets, Uncertainty and Information”, Prentice Hall of India Pvt.Ltd.,1993 .
7. Zimmerman,H.J. “Fuzzy Set Theory and its Applications”, Kluwer Academic Publishers,1994.
8. IEEE tutorial on “Application of Neural Network to Power Systems”, 1996
9. Loi Lei Lai , “Intelligent System Applications in Power Engineering”, John Wiley and Sons Ltd., 1998
10. *EthemAlpaydin, “Introduction to Machine learning (Adaptive Computation and Machine Learning series)’, MIT Press, Second Edition, 2010.*

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.A.BALAMURUGAN	Associate Professor	EEE/VMKVEC	balamurugan@vmkvec.edu.in
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17EESE03	MODELING AND ANALYSIS OF ELECTRICAL MACHINES	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBLE

To understand and familiarize the principle, Modeling Concepts of Electrical machines

COURSE OBJECTIVES

1	To provide knowledge about the fundamentals of magnetic circuits, energy, force and torque of multi-excited systems.
2	To analyze the steady state and dynamic state operation of DC machine through mathematical modeling and simulation in digital computer.
3	To provide the knowledge of theory of transformation of three phase variables to two phase variables.
4	To analyze the steady state and dynamic state operation of three-phase induction machines using transformation theory based mathematical modeling and digital computer simulation.
5	To analyze the steady state and dynamic state operation of three-phase synchronous machines using transformation theory based mathematical modeling and digital computer simulation.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Understand the various electrical parameters in mathematical form.	Understand
CO2: Analyze the performance of DC machines in all the aspects through the mathematical formations.	Analyze
CO3: Understand the different types of reference frame theories and transformation Relationships	Understand
CO4: Design the induction machine also can able to find the equivalent circuit parameters	Create
CO5: Predetermine the performance of Synchronous machines at stand still and running conditions.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	-	-	-	-	L	-	
CO2	S	S	-	M	-	-	-	-	-	-	-	-	S	-	
CO3	S	L	-	-	M	-	-	-	-	-	-	-	M	-	M
CO4	S	S	S	S	S	-	-	-	-	-	-	-	S	S	M
CO5	S	S	M	M	-	-	-	-	-	-	-	--	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION

Magnetic circuits, permanent magnet, stored magnetic energy, co-energy - force and torque in singly and doubly excited systems – machine windings and air gap mmf - winding inductances and voltage equations.

DC MACHINES

Elementary DC machine and analysis of steady state operation - Voltage and torque equations – dynamic characteristics of permanent magnet and shunt d.c. motors – Time domain block diagrams - solution of dynamic characteristic by Laplace transformation – digital computer simulation of permanent magnet and shunt D.C. machines.

REFERENCE FRAME

Historical background – phase transformation and commutator transformation – transformation of variables from stationary to arbitrary reference frame - variables observed from several frames of reference.

INDUCTION MACHINES

Three phase induction machine, equivalent circuit and analysis of steady state operation – free acceleration characteristics – voltage and torque equations in machine variables and arbitrary reference frame variables – analysis of dynamic performance for load torque variations – digital computer simulation.

SYNCHRONOUS MACHINES

Three phase synchronous machine and analysis of steady state operation - voltage and torque equations in machine variables and rotor reference frame variables (Park's equations) – analysis of dynamic performance for load torque variations – Generalized theory of rotating electrical machine and Krons primitive machine.

REFERENCES

1. Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley, Second Edition, 2010.
2. P S Bimbhra, "Generalized Theory of Electrical Machines", Khanna Publishers, 2008
3. A.E, Fitzgerald, Charles Kingsley, Jr, and Stephan D, Umanx, " Electric Machinery", Tata McGraw Hill, 5th Edition, 1992
4. R. Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, New Delhi, Prentice Hall of India, 2001

COURSE DESIGNERS

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17EESE05	TRANSIENTS IN POWER SYSTEM	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBLE

To review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also, to study propagation, reflection and refraction of these surges on the equipment their impact on the power system grid.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To study the generation of switching transients and their control using circuit – theoretical concept.
2	To study the mechanism of lighting strokes and the production of lighting surges.
3	To study analysis in time and frequency domain Z-transform.
4	To study the Insulation coordination as applied to transformer, substations.
5	To study simulation of electromagnetic transients.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Relate of various types of power system transients	Remember
CO2: Determine the switching surges of various faults in power system .	Understand
CO3: Correlate the insulation coordination as applied to transformer, substations.	Analyze
CO4: Calculate of the computation of transients in conversion equipment	Analyze
CO5: Design the basic idea about simulation of electromagnetic .	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	S	L	M	M	-	M	S	-	-	-	L	S	L
CO2	L	M	M		M	M	-	M	S	-	-	-	M	S	L
CO3	M	L	S	M	M	M	-	M	S	-	-	-	S	S	L
CO4	M	M	S	L	-	M	-	M	S	-	-	-	L	M	L
CO5	S	M	-	L	-	-	-	-	S	-	-	-	M	L	M

S- Strong; M-Medium; L-Low

INTRODUCTION AND LIGHTNING SURGES

Review of various types of power system transients – effect of transients on power systems- relevance of the study and computation of power system transients. Electrification of thunderclouds – lightning current stages – lightning current parameters and their values – stroke to tower and midspan – induced lightning surges.

SWITCHING SURGES

Closing and reclosing of lines – load rejection – fault initiation – fault clearing – short line faults – Ferro Resonance – isolator switching surges – temporary over voltages – surges on an integrated systems – switching – harmonics.

COMPUTATION OF TRANSIENTS IN CONVERSION EQUIPMENT

Traveling wave method – Beweley's Lattice diagram – analysis in time and frequency domain – eigenvalue approach – Z-transform.

INSULATION CO ORDINATION

Over voltage protective devices – shielding wires, rods gaps, surge diverters, principles of insulation co-ordination – recent advancements in insulation co ordination – Design of EHV system – Insulation co ordination as applied to transformer, substations.

CASE STUDIES-SIMULATION OF ELECTROMAGNETIC TRANSIENTS

(i) Energisation of a single phase 0.95 pf load from a non ideal source and a realisticline representation.

(ii) Energisation of a single phase 15 mile long line from an ideal voltage source (equivalent-) – lumped and distributed parameter representation.

(iii) Energisation of a 3 phase, 15 mile distributed parameter line connected to a transformer and RL load, (three phase closure simulations).

(iv) Same as above but only one phase closed.

(v) Energisation of a 120 mile transposed line from an ideal voltage source.(Adequate model needed)

Total Hours =45

REFERENCES

1. Allan Greenwood, "Electrical Transients in Power Systems", Willey Interscience, New York, 1971.
2. Klaus Ragaller, "Surges in High Voltage Networks", Plenum Press, New York,1980.
3. Diesendorf, W., "Over Voltage on High Voltage Systems", Renselaer Bookstore, Troy New York, 1971.
4. Peterson,H.A., "Transient in Power Systems", Dover Publication, New York, 1963.
5. Rakosh das Begamudre, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Ltd, New Delhi, 1990.
6. C.S.Indulkar, DP Kothari, "Power System Transients" - A Statistical approach , Prentice Hall 1996.

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17CSEC29	TCP/IP TECHNOLOGY	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

To define a specific series of transmission criteria that is understood to mean someone is about to transmit data. Proper timing is required to ensure that all systems are interpreting the start of the information transfer correctly. The actual preamble varies depending on the network communication technology in use.

PREREQUISITE

COMPUTER NETWORKS

COURSE OBJECTIVES

1	To understand the concepts and techniques used to design and implement the TCP/IP Internet and it also helps to develop protocols to broaden and enhance the operation of the Internet
2	To Understand the transport layer protocol and its characteristics
3	To Work with client server sockets and develop related applications to communicate with each other
4	To Learn and understand IPv6 and wide area network technologies

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the overview of the transport layer protocols.	Understand
CO2: Implement client server communication using socket programming for various applications.	Understand
CO3: Analyze the performance of application layer protocols, and types.	Apply
CO4: Construct routing and forwarding solutions for Tunneling and Translation Techniques.	Analyze
CO5: Implement wan technologies **f**or packet switching networks, with an understanding of the underlying switching techniques.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	M	-	-	-	-	-	-	M	-	M	M
CO2	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M
CO3	S	M	L	-	L	-	-	-	-	-	-	L	-	M	M
CO4	S	-	L	-	M	-	-	-	-	-	-	M	-	M	M
CO5	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

TRANSPORT LAYER PROTOCOLS

TCP & UDP datagram and its characteristics, RTP, Flow Control and Error Control Mechanisms, Silly Window Syndrome-Clark's and Nagle Algorithm -Congestion Control Mechanisms -Token Bucket and Leaky Bucket

SOCKET PROGRAMMING

Introduction to socket programming-Concurrent Processing in Client- Server Software-Byte ordering and address conversion functions –Socket Interface -System calls used with sockets -Iterative server and concurrent server-Multi protocol and Multi service server-TCP/UDP Client server programs –Thread Creation and Termination –TCP Echo Server using threads-Remote Procedure Call

APPLICATION LAYER PROTOCOLS

Client Server Model: DNS, TELNET, FTP -HTTP: Introduction,performance, caching and proxies–WWW-DHCP -DORA -Electronic Mail -SMTP, POP3 -PING, TRACE ROUTE.

NEXT GENERATION INTERNET PROTOCOL

Introduction to IPv6 –IPv6 advanced features –V4 and V6 headercomparison –V6 address types –Stateless auto configuration–IPv6 routing protocols –IPv4-V6 Tunnelling and Translation Techniques.

WAN TECHNOLOGIES

Electromagnetic Spectrum -DSL and Cable Technology -Packet Switching–HDLC, PPP, Frame Relay, ATM, MPLS, WIFI and WIMAX.

TEXT BOOKS

1.Douglas E. Comer,Internetworking with TCP/IP, Principles, protocols, and architecture, Vol 1 5thEdition, Publication Date: July 10, 2005| ISBN-10:0131876716 | ISBN-13:9780131876712

2.Douglas E. Comer, Internetworking with TCP/IP principles, Volume III, Client-Servesr Programming and Application, Publication Date: September 21, 2000| ISBN-10:0130320714 | ISBN-13:978-0130320711| Edition1.

REFERENCES

1.Wendell Odom, Official Certification Guide, CCNP Route 642-902, CCIE, Pearson publication.

2.Behrouz A. Forouzan, Data Communications and Networking, 5thedition,July 1, 2012, ISBN-10:0073376221,ISBN-13:978-0073376226

COURSE DESIGNERS

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17EESE81	POWER SYSTEM SIMULATION LAB - I	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

The course provides software skill development and experience in the usage of standard packages necessary for analysis and simulation of power system required for its planning, operation and control.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To compare the parameters and modeling of transmission lines and formation of bus admittance matrix and impedance matrix.
2	To obtain the solution of power flow using gauss seidel method, Newton Raphson method and Fast decoupled method.
3	To obtain the symmetrical fault and unsymmetrical fault analysis.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Design the parameters of transmission lines for electrical power systems.	Create
CO2: Design the admittance and impedance matrices of electrical systems.	Create
CO3: Estimate the power flow analysis of the power system engineering using gauss seidel method, Newton Raphson method and Fast decoupled method.	Evaluate
CO4: Simulate the symmetrical fault and unsymmetrical fault of various electrical power systems.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	S	M	S	L	-	-	M	M	S	L	S	M	L
CO2	S	M	S	M	S	L	-	-	M	M	S	L	S	M	L
CO3	S	M	M	L	S	L	M	L	M	M	S	L	S	S	M
CO4	S	M	M	L	S	L	L	L	M	M	S	L	S	S	M

S- Strong; M-Medium; L-Low

LIST OF EXPERIMENTS

1. *Computation of parameters and modeling of transmission lines.*
2. *Formation of bus admittance and bus impedance matrices and solution of networks.*
3. *Solution of power flow using Gauss-Seidel Method.*
4. *Solution of power flow using Newton-Raphson method.*
5. *Solution of power flow using Fast-decoupled method.*
6. *Symmetrical fault analysis.*
7. *Unsymmetrical fault analysis.*

Reference Books

Laboratory Reference Manual

COURSE DESIGNERS

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17EESE82	POWER SYSTEM SIMULATION LAB– II	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

To study about the concepts of power system simulation laboratory.

PREREQUISITE : 17EESE81-Power system simulation – I Lab

COURSE OJECTIVES

1	To study about the Contingency analysis, Small signal stability analysis, transient stability analysis, analysis of switching surge using EMTP.
2	To study about the economic dispatch, Unit commitment solution method, co ordination of over current and distance relays.
3	To study about the concept of induction motor starting analysis.

COURSE OUTCOMES

On the successful completion of the course ,students will be able to

CO1: Analysis the power system network	Analyze
CO2: Develop the economic dispatch for any line constraints	Analyze
CO3: Apply the appropriate protection for power system relays	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PSO3
CO1	S	M	-	-	-	-	-	-	-	-		M	M	-	-
CO2	S	S	M	-	-	-	-	-	-	-	M	S	S	M	-
CO3	S	M	-	-	-	-	-	-	-	-		M	M	-	M

S-Strong,M-Medium, L-Low

LIST OF EXPERIMENTS

1. Contingency analysis: Generator shift factors and line outage distribution factors
2. Small signal stability analysis: SMIB and Multi machine configuration
3. Transient stability analysis of Multi – machine configuration
4. Economic dispatch with line flow constraints
5. Unit commitment: Priority-list schemes and dynamic programming
6. Co-ordination of over current and distance relays for radial line protection
7. Induction motor starting analysis
8. Analysis of switching surge using EMTP.

Reference Books

Laboratory Reference manual

COURSE DESIGNERS

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17EESE83	POWER ELECTRONICS SIMULATION LAB -I	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

The course provides practical knowledge of power Electronics devices and Characteristics for various devices.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To simulate and design of various gate firing circuits.
2	To familiarize the students by introducing softwares like P- sim, Multisim, and help them to simulate and analyze the different types of converters.
3	To enable the students to study & simulate circuits using Matlab software and on hardware Modules.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Design and Analyse of various Power control converter simulation and tools.	Understand
CO2	Use the techniques, skills and modern engineering tools necessary for engineering applications.	Analyze and Create
CO3	Identify, formulate & solve engineering problems with simulation tool.	Apply
CO4	Simulate the characteristics of SCR, MOSFET, IGBT.	Analyze
CO5	Simulate gate firing circuits for various power Applications	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	L	M		M		L			L	L	M	L
CO2	L	S	M	L	S				M			M	M	S	
CO3	M	M	L		S	L	M				L	M	M	S	L
CO4	L	L	M		L				L	L	M		S	S	
CO5	S	S	M	L	S	M	L		M	L		M	S	S	L

S- Strong; M-Medium; L-Low

SYLLABUS

STUDY EXPERIMENTS

1.Study of characteristics of SCR,TRIAC, DIAC

2.Study of Gate firing circuits

SIMULATION EXPERIMENTS

1.Characteristics of SCR, TRIAC, DIAC

2. Characteristics of power MOSFET, IGBT

3. Characteristics of UJT

4. Single Phase Half wave controlled converter with R,RL&RLE Load with/without FD
5. Single Phase Half controlled converter with R,RL&RLE Load with/without FD
6. Single Phase Full controlled converter with R,RL&RLE Load with/without FD
7. Three Phase semi controlled converter with R,RL&RLE Load
8. Three Phase full controlled converter with R,RL&RLE Load
9. Design and Modeling of UJT Triggering for Various Power Converters

TEXT BOOKS

1 Laboratory Reference manual - VMRFDU

COURSE DESIGNERS

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17EESE84	POWER ELECTRONICS SIMULATION LAB - II	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

To provide hands on experience on the equipment for converters, inverters, choppers and simulation of closed loop control for electrical drives

PREREQUISITE :17EESE83- Power electronics simulation lab-1

COURSE OJECTIVES

1	To design the simulation circuit for controlling the speed of DC and AC Motors
2	To design the simulation circuit and to analysis the performance of single phase, three phase half & full controlled rectifier
3	To simulate voltage and current commutated chopper
4	To design and run the simulation models of inverter and voltage controller
5	To design the simulation circuit for cycloconverter and to analyse the performance.

COURSE OUTCOMES

On the successful completion of the course ,students will be able to

CO1: Apply the appropriate technique to control the speed of AC and DC motors.	Apply
CO2: Analyze the performance of Chopper	Analyze
CO3: Design the simulation circuits for analyzing the performance of power electronics controllers	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PSO3
CO1	S	M	-	-	-	-	-	-	-	-		M	M	-	-
CO2	S	S	M	-	-	-	-	-	-	-	M	S	S	M	-
CO3	S	M	-	-	-	-	-	-	-	-		M	M	-	M

S-Strong,M-Medium, L-Low

LIST OF EXPERIMENTS

1. Speed control of DC Shunt motor.
2. Speed control of PWM inverter fed three–phase induction motor.
3. Voltage commutated chopper.
4. Current commutated chopper.
5. Mc Murray – Bedford inverter.
6. AC voltage controller.
7. Series inverter.
8. Cycloconverter.

Reference Books

Laboratory Reference manual

COURSE DESIGNERS

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17EESE06	NON CONVENTIONAL ENERGY SOURCES AND APPLICATIONS	Category	L	T	P	Credit
		SE	3	0	0	3

PREAMBLE

To study the fundamentals of non conventional sources due to crisis of conventional sources and understand the fundamentals and application of Non-conventional energy sources in the energy sector.

PREREQUISITE: NIL.

COURSE OBJECTIVES

1	To study about energy Sources and its types, scope of Renewable energy
2	To understand about solar energy and various types of solar energy & conversion methods
3	To understand about wind energy system & its component, and Analyze the selection factor & output power
4	To study about the Basics Biomass & geothermal energy and its various sources
5	To study different forms of non-conventional energy.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO 1	To Understand the renewable energy sources & systems.	Understand
CO 2	To impart the techniques of solar energy and different methods.	Understand
CO 3	To impart the knowledge of Storage technologies from the autonomous renewable energy sources.	Understand
CO 4	To analyze the wind turbine system and components.	Analyze
CO 5	To analyze biomass and geothermal energy generations	Apply
CO 6	Recognize the need and ability to engage in lifelong learning for further developments in this field.	Analyze
CO7	Conduct experiments to assess the performance of solar PV, wind, Geothermal energy systems.	Analyze
CO 8	Pursue further research work behind the development of non-conventional energy sources as a part of their research work.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	-	L	L	-	-	-	-	-	-	-
CO2	S	M	S	L	M	-	L	M	-	-	-	-	-	-	-
CO3	S	-	-	-	M	-	-	-	-	-	-	-	-	-	-
CO4	S	-	-	-	M	-	-	-	-	-	-	-	-	-	-
CO5	S	M	S	L	M	-	L	M	-	M	M	-	-	-	-
CO6	S	-	-	-	M	-	L	L	-	-	-	-	-	-	-
CO7	S	-	S	-	M	-	M	M	-	-	M	-	-	-	-
CO8	S	-	S	-	M	-	M	M	-	-	L	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO ENERGY SOURCES

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.

SOLAR ENERGY

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.

WIND ENERGY

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

BIOMASS AND GEOTHERMAL ENERGY

Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantage es, constructional details, site selection, Fuel properties of bio gas, utilization of biogas. geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy.

OTHER ALTERNATE ENERGY SOURCES

Energy from tides, basic principle of tidal power, Basics of Magneto Hydro Dynamic (MHD) Power Generation, Basic Fuel Cells construction and Operation, hydrogen as alternative fuel for vehicles.

Text Books

1. *Non-conventional energy sources by G.D. Rai, Khanna Publishers.*
2. *Solar Energy: Fundamentals and Applications by H.P. Garg& Jai Prakash, Tata McGraw Hill.*
3. *Solar Energy: Principles of Thermal Collection and Storage by S,PSukhatme, Tata McGraw Hill.*

Reference Books

1. *Alternative Energy Sources by B.L. Singhal Tech Max Publication.*
2. *Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma.*
3. *Fuel Cells by Bockris and Srinivasan; McGraw Hill.*
4. *Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison.*
5. *Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley*

COURSE DESIGNERS

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17SACC05	**SOLAR COLLECTORS AND THERMAL ENERGY CONVERSION**	Category	L	T	P	C
	Total Contact Hours – 45	SE	3	0	0	3
	Prerequisite – NIL					
	Co-requisite - NIL					

Preamble

To familiarize the students with principles of operation, structure, testing and installation of major types of solar collectors. To study fundamentals and application of solar thermal systems for heating, cooling, power genera other applications.

COURSE OBJECTIVES

1	Understand the fundamentals of solar flat plate collectors.
2	Understand the fundamentals of concentrating solar collectors
3	Analyse the performance of concentrating solar collectors
4	The basics of solar thermal technology for process heating applications
5	The fundamentals of design calculations and economics of solar power generation.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Understand the scope of solar thermal energy in India.	Understand
CO 2	Apply the solar thermal energy concepts for real time problems	Apply
CO 3	Estimation of solar energy requirement for thermal applications	Estimate
CO 4	Design of different solar thermal equipment using concentrating and non-concentrating solar collectors	Create
C0 5	Analyze the performance of designed solar thermal collectors	Analyze

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	L	M						L		M			
CO2	M	M	L	M						M		M			
CO3	S	S	M	L	S				L			M			
CO4	S	S	S	M	S	M	M	M	M	M	L	M			
CO5	S	S	L	S	L				L	M					

SYLLABUS

UNIT - I	INTRODUCTION 9
Scope of Solar Thermal Energy in India – Schematic of a Solar Thermal Power Plant- Solar atlas of India - Types of Solar Collectors – Introduction to basic thermodynamic cycles involved with thermal collectors- Carnot cycle - Rankine cycle.	
UNIT - II	**QUANTITATIVE TECHNIQUES 9**
Fundamentals of solar collectors as devices to convert solar energy to heat. Non concentrating low temperature flat-plate and evacuated tube collectors. Design and structures of collectors for heating liquids and air. Optimal collector tilt and orientation. Collector performance - Useful energy gain, energy losses, efficiency. Use of selective coatings to enhance the collector efficiency.	
UNIT - III	**SOLAR LIQUID AND AIR HEATING SYSTEM 9**
Flat plate collector – Liquid and air heating - Evacuated tubular collectors - Overall heat loss coefficient, heat capacity effect - Thermal analysis. Design of solar water heating systems, with natural and pump circulation(Quantitative analysis). Solar dryers and applications. Thermal energy storage systems.	
UNIT - IV	**SOLAR COOLING 9**
Solar thermo-mechanical refrigeration system – Carnot refrigeration cycle, solar electric compression air conditioning, simple Rankine cycle air conditioning system. Absorption refrigeration – Thermodynamic analysis	
UNIT - V	**SOLAR THERMAL POWER PLANTS 9**
Solar thermal electric power plants based on parabolic trough, solar central receiver, parabolic dish-Stirling engine. Concentrated solar power using Fresnel lenses. Fundamentals of design calculations and analysis of solar power plants. Economic analysis.	

TEXTBOOK

1. 1.*Duffie, J. A. & W. A. Beckman., "Solar Engineering of Thermal Processes", 3rd edition, John Wiley & Sons, Inc., 2006.*
2. *H.P.Garg, J.Prakash., "Solar energy fundamentals and applications", Tata McGraw Hill publishing Co. Ltd, 2006.*

REFERENCES

1. *Duffie, J. A. & W. A. Beckman., "Solar Engineering of Thermal Processes", 3rd edition, John Wiley & Sons, Inc., 2006.*
2. *H.P.Garg, J.Prakash., "Solar energy fundamentals and applications", Tata McGraw Hill publishing Co. Ltd, 2006.*

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. S.M.Santhi Rekha	AP	EEE	santhirekha.eee@avit.ac.in

17SACC10	**ENERGY CONSERVATION AND MANAGEMENT**	Category	L	T	P	C
	Total Contact Hours – 45	CC	3	0	0	3
	Prerequisite – Non Conventional Energy Sources					

Preamble

To enable the students to acquire the knowledge of energy conservation measures in thermal and electrical energy

COURSE OBJECTIVES

1	To impart knowledge on energy management and facilitate application of energy conservation techniques in process industries.
2	To impart knowledge on thermal and electrical utilities for evaluating energy saving potential.
3	To learn the positions of energy management in energy intensive industries using various model and chart.
4	To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment.
5	To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Acquaintance with conservation of energy and its management, energy planning, and energy economics.	Analyze
CO 2	Recognize - How of energy efficient machinery systems, energy losses and their management	Evaluate
CO 3	Ability in Energy analysis techniques and methods & Energy conservation planning and practices.	Understand
CO 4	Estimate the techno economic feasibility of the energy conservation technique adopted.	Apply
C0 5	Evaluate the performance of thermal utilities like furnace, boilers and steam distribution systems to improve efficiency	Creating
CO6	Takeout performance assessment and suggest methods to improve the overall efficiency for different energy intensive industries	Analyze

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	L	M	S	-	-	-	-	L	-	-	L	L	-	-
CO2	L	-	M	L	-	L	-	L	-	-	-	-	L	-	-
CO3	L	-	L	-	-	-	-	-	-	-	-	-	-	M	-
CO4	S	-	L	-	-	M	-	-	L	-	-	-	-	L	-
CO5	L	M	S	M		-	-	-	-	-	-	-	-	-	L
CO6	M	-	L	-	-	M	-	-	-	-	-	L	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

ENERGY CONSERVATION PRINCIPLES

Energy scenario, principles of energy conservation, resource availability, energy savings, current energy consumption in India, roles and responsibilities of energy managers in industries.

ELECTRICAL SYSTEMS

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in

ENERGY CONSERVATION IN THERMAL SYSTEMS

Energy conservation in thermal utilities like boilers, furnaces, pumps and fans, compressors, cogeneration - steam and gas turbines. Heat exchangers, lighting system, motors, belts and drives,

ENERGY CONSERVATION IN ELECTRICAL SYSTEMS

Potential areas for electrical energy conservation in various industries, conservation methods, energy management opportunities in electrical heating, lighting system, cable selection, energy efficient motors, factors involved in determination of motor efficiency, adjustable AC drives, variable speed drives, energy efficiency in electrical system

ENERGY MANAGEMENT

Organizational background desired for energy management persuasion, motivation, publicity role, tariff analysis, industrial energy management systems, energy monitoring, auditing and targeting, economics of various energy conservation schemes – energy policy and energy labeling.

TEXTBOOK

1. Reay .D.A, "Industrial Energy Conservation", Pergamon Press, 1st edition, 2003.
2. White .L. C, "Industrial Energy Management and Utilization", Hemisphere Publishers, 2002.

REFERENCES

1. Beggs, Clive, "Energy – Management, Supply and Conservation", Taylor and Francis, 2nd edition, 2009.
2. Smith .C.B, "Energy "Management Principles", Pergamon Press, 2006.
3. Hamies, "Energy Auditing and Conservation; Methods, Measurements, Management and Case study", Hemisphere, 2003.
4. Trivedi .P.R and Jolka .K.R, "Energy Management", Common Wealth Publication, 2002..

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. K.Boopathy	Professor	EEE/AVIT	boopathyk@avit.ac.in
2	Mrs. V.Manjula	AP	EEE/VMKVEC	manjula@vmkvec.edu.in

17EESE07	**CONCEPTS OF GREEN BUILDING**	Category	L	T	P	C
	Total Contact Hours – 45	SE	3	0	0	3
	Prerequisite – NIL					
	Co-requisite - NIL					

Preamble

To have a Sustainable architecture for creating an environment friendly and energy efficient building by harnessing renewable sources of energy and utilizing materials that least pollute the environment.

COURSE OBJECTIVES

1	To create awareness for the need of green buildings and imparting knowledge of designing green buildings.
2	To understand the applications of passive and active use of renewable energy system
3	To promote the efficient use of water, materials and waste through the sustainable concept of Reduce, Recycle and Reuse.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	To Understand the designing and concept of an environmentally friendly building (low-emissions, low resource-consumption, small environmental footprint)	Understand
CO 2	To describe the Concepts of different Heating techniques available for Sustainable Design And Green Building Environment Analyze	Remember
CO 3	To describe the Concepts of different passive cooling techniques available for Sustainable Design And Green Building Environment Analyze	Remember
CO 4	To analyse and determine the different Use of Environment friendly materials and find the methods of recycling and reuse	Apply
C0 5	To know about the innovative green technologies methods and case study of a buildings	Understand

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L			S	S			L					
CO2	M		M		S	L	M		M	L					
CO3	M		M		S	L	M			L					
CO4	S		S		S	M	M	L		L	M				
CO5	S	M	S	S	S	M	S		M	L	L	M			

SYLLABUS

UNIT - I	INTRODUCTION 9
Green buildings- salients features- LEED rating systems by IGBC - origin from USGBC –Concept of Sustainable sites –Orientation to sun and Wind -Land form & orientation – Vegetation & Pattern – Water Bodies– Open Space & Built form.	
UNIT - II	**PASSIVE AND ACTIVE HEATING TECHNIQUES 9**
Passive Cooling techniques : General principles – Evaporative cooling, Nocturnal radiation cooling, Passive Dessicant cooling, induced ventilation, earth sheltering, Berming, Wind Towers, earth – Air tunnels, Curved Roofs & Air Vents, Active Cooling techniques : Air coolers	
UNIT - III	**PASSIVE AND ACTIVE COOLING CONCEPTS 9**
Passive Cooling techniques : General principles – Evaporative cooling, Nocturnal radiation cooling, Passive Dessicant cooling, induced ventilation, earth sheltering, Berming, Wind Towers, earth – Air tunnels, Curved Roofs & Air Vents, Active Cooling techniques : Air coolers	
UNIT - IV	**REDUCE, RECYCLE AND REUSE 9**
Water conservation by Rainwater Harvesting systems – Treatment of waste water: Physical, Chemical and Biological methods – Root Zone treatment -Use of recycled water. Use of Environment friendly materials, Bio degradable materials. Recycling and Reuse of steel, Aluminium and Glass.	
UNIT - V	**INNOVATIVE GREEN TECHNOLOGIES AND CASE STUDIES 9**
Innovative uses of solar energy : BIPV, Solar Forest,Solar powered street elements-Integrated Use of Landscape : Vertical Landscape, Green Wall, Green Roof.Case studies on Green buildings : Olympia Technology Park, Chennai.	

TEXTBOOK

1.Sustainable design manual, Vols 1& 2, The energy and resource institute, New Delhi.

REFERENCES

1. *Arvind Krishnan & Others – Climate Responsive Architecture, Tata Mcgraw –Hill New Delhi 2001.*
2. *Ralph M .Lebens – Passive Solar Architecture in Europe – 2, Architecture Press, London 1983.*
3. *Sandra Mendler, William Odell, The Guide Book Of Sustainable Design, John Wiley & Sons, 2000.*
4. *Lawson.B,Bulding Materials, Energy And The Environment; Towards Ecologically Sustainable Development Raia, Act, 1996*

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	P.Poornima	AP(Gr-II)	EEE	poorni07p@gmail.com

17EEEC34	NUCLEAR REACTOR THEORY	Category	L	T	P	C
	Total Contact Hours – 45	EC-PS	3	0	0	3
	Prerequisite – Nil					

Preamble

The ultimate aim of this course is to have deeper understanding of the contemporary and the recent researches in nuclear engineering applications.

COURSE OBJECTIVES

1	To study the Fundamental concepts of Nuclear systems. To analyse the Nuclear data, reaction rates.
2	To provide the students with description of the computational methods for nuclear engineering applications.
3	To perform analytical and numerical calculations necessary in nuclear system research and development. To understand the Core Composition changes during Reactor operation.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Remember the Fundamentals concepts of Nuclear systems	Remember
CO 2	Analyse the Nuclear data, reaction rates.	Analyse
CO 3	Knowing the computational methods for nuclear engineering applications.	Evaluate
CO 4	Knowledge about the analytical and numerical calculations necessary in nuclear system research and development .	Analyse and evaluate
C0 5	Information about Core Composition changes during Reactor operation.	Remember

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	S	M	L	-	-	-	-	S	M	S
CO2	S	M	M	-	M	S	S	M	M	-	-	-	S	S	S
CO3	S	S	M	S	L	M	-	-	-	L	-	-	S	M	S
CO4	S	M	M	M	-	L	-	-	-	L	L	L	S	S	S
CO5	S	S	S	M	L	M	L	L	-	-	-	-	S	M	S

SYLLABUS

INTRODUCTION
Course overview - Fundamental concepts- Nuclear energetic -Radioactivity-Binary nuclear reactions, neutron nuclear reactions- Principles of nuclear reactors, nuclear power.
FUNDAMENTALS OF NUCLEAR SYSTEMS
Characteristics of the fission reaction, neutron moderation, practical fission fuels-Reactor power, fuel burn up, and fuel consumption-Neutron chain-reacting systems-Homogeneous and heterogeneous cores, reflectors, Reactor kinetics and dynamics, reactivity feedback- Core composition changes during reactor operation, nuclear system lifetime
MATHEMATICAL DESCRIPTION OF PHYSICAL PHENOMENA : NEUTRON AND MODELLING METHODS
General considerations about reactor physics, engineering requirements- Description of the neutron distribution: fluxes, currents, and sources-Nuclear data, cross sections, and reaction rates- Basic scheme of nuclear system modeling methods-Deterministic modeling of nuclear systems-Neutron balance (conservation) equations
NUCLEAR DATA AND CROSS SECTION PROCESSING
Cross-section data- Evaluated nuclear data files-Introduction to the data formats and procedures of the ENDF-6 system-NJOY nuclear data processing system, multigroup cross section libraries.
CORE COMPOSITION CHANGES DURING REACTOR OPERATION
Core composition changes-Nuclide production-destruction equations, adiabatic fuel depletion modelling Equilibrium fuel cycle-Solution of the nuclide production-destruction equations-Reactivity effects of fuel composition changes
TEXTBOOK
1. W. M. Stacey, Nuclear Reactor Physics, John Wiley & Sons, 2001 2. J. J. Duderstadt, L. J. Hamilton, Nuclear Reactor Analysis, John Wiley & Sons, 1976
REFERENCES
1. J.R.Lamarsh, Introduction to Nuclear Reactor Theory, Addison-Wesley Pub., 1966 . 2. J. R. Lamarsh, A. J. Baratta, Introduction to Nuclear Engineering, 3d ed., 2001
COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	P.Poornima	AP(Gr-II)	EEE	poornima@avit.ac.in
2	Mr.P.Loganathan	AP	EEE	loganathan@vmkvec.edu.in

17EESE09	CONVENTIONAL AND ALTERNATIVE ENERGY SYSTEMS	Category	L	T	P	C
	Total Contact Hours – 45	SE	3	0	0	3
	Prerequisite – NIL					
	Co-requisite - NIL					

Preamble

This course provides the knowledge of working principles of conventional power generation and the importance of renewable energy sources.

COURSE OBJECTIVES

1	The operating principles and components of steam and nuclear power plant.
2	The operating principles and components of hydro, gas turbine power plants.
3	The solar and wind energy conversion systems.
4	The biomass, tidal and geothermal power plants.
5	The operating principles of hydrogen energy, fuel cells and MHD power generation.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO 1	Remember the Fundamentals concepts of Steam and Nuclear Power Generation	Remember
CO 2	Understand the performance of hydro, Gas turbine plants	Understand
CO 3	Understand the concept of solar and wind energy conversion system	Understand
CO 4	Have an idea about Tidal, Bio mass, Geothermal resources and power generation.	Understand
C0 5	Design and develop suitable hydrogen storage system to be used along with fuel cell system.	Apply

Mapping with Programme outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L			S	S			L					
CO2	M		M		S	L	M		M	L					
CO3	M		M		S	L	M			L					
CO4	S		S		S	M	M	L		L	M				
CO5	S	M	S	S	S	M	S		M	L	L	M			

SYLLABUS

UNIT - I	STEAM AND NUCLEAR POWER GENERATION 9

Steam power plant-Selection of site-Generated layout-coal and ash handling-Steam generating plants-Feed make circuit - Cooling towers-Turbine governing, plant performance enhancement techniques, advanced technologies for coal-fired power plants, supercritical and ultra-supercritical steam power plants, power plant major and auxiliary equipment. Nuclear power plants–Classification- Nuclear Fuels.

UNIT - II	HYDRO, GAS TURBINE AND COMBINED CYCLE PLANTS 9

Hydro power plant - Selection of Site - Classification layout governing of turbines - Gas turbine power plants - Performance enhancement techniques, equipment. combined cycle power pants, integrated gasification combined cycle, cogeneration plant - Equipment and performance.

UNIT - III	SOLAR AND WIND ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar thermal collectors – Flat plate and concentrating collectors – Solar applications – Fundamentals of photo voltaic conversion – Solar cells – PV applications. Wind data and energy estimation – Wind energy Conversion systems – Wind energy generators and performance.

UNIT - IV	BIOMASS, TIDAL AND GEOTHERMAL ENERGY SOURCES 9

Biomass – Biogas, source, composition - Technology for utilization – Biomass direct combustion, biomass gasifier, biogas plant, digesters, ethanol production, Bio-diesel production and economics. Tidal energy – Wave energy – Technology options – Open and closed OTEC cycles. Geothermal energy sources, power plant and environmental issues.

UNIT - V	HYDROGEN, FUEL CELL AND MHD POWER 9

Hydrogen, generation, storage, transport and utilization and transport. Fuel cell technology – Types, power generation and economics. MHD power generation – Principle, classification, design problems and developments.

TEXTBOOK

"1. Rai .G.D, “Non Conventional Energy Sources”, 4th edition, Khanna Publishers, New Delhi, 2000.
2. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.

REFERENCES

1. *Sukhatme .S.P, “Solar Energy”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1997.*
2. *Khartchenko .N.V, “Advanced Energy Systems”, Taylor and Francis, Washington DC, 1998.*
3. *Chauhan .D.S, Srivastava .S.K, “Non-Conventional Energy Resources”, New Age, 2009*
4. *M.C, “Energy Systems Engineering”, Wiley-VCH, 2008.*
5. *Rajput .R.K, “Power Plant Engineering”, 4th ed., Laxmi Publ., 2008.*

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	P.Poornima	AP(Gr-II)	EEE	poorni07p@gmail.com

17SACC81	**SOLAR ENERGY LABORATORY**	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as *solar* heating, photovoltaics, *solar* thermal *energy*, *solar* architecture, molten salt *power* plants and artificial photosynthesis. This laboratory mainly deals with the solar PV part. The electrical parameters are mainly concentrated.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand the behavior of PV Solar panel in different combinations
2	To understand the power flow with different types of loads
3	To understand the behavior battery connected and grid connected system.

COURSE OUTCOMES

On the successful completion of the laboratory course, students will be able to

CO1. Understand the various characteristics of PV Panels	Understand
CO2. Understand Power flow calculations with different load	Understand
CO3. Explain Performance of a PV system with batteries	Understand
CO4. Understand the grid connected performance of a PV system	Understand
CO5. Understand the islanding and other abnormal conditions	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO2	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO3	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO4	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO5	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. I-V and P-V characteristics with series and parallel combination of modules.
2. Effect of variation in tilt angle and shading on PV module power.
3. Power flow calculations of standalone PV system of DC load with battery.
4. Power flow calculations of standalone PV system of AC load with battery.
5. Power flow calculations of standalone PV system of DC and AC load with battery
6. Charging and discharging characteristics of battery.
7. Interfacing of hardware using RS232 ports and suitable software.
8. Evaluation of Active, Reactive Power & Apparent Energy Flow between Grid-Tied Inverter, Grid & Load and Net Metering concept
9. Grid Synchronization of Solar PV Inverter and it Performance Analysis
10. Impact of Transmission Line Inductance on Voltage Quality at PCC.

References

1. *Laboratory reference manual*

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	V.Rattan Kumar	AP(II)	EEE	rattankumar@avit.ac.in

17SACC82	**WIND ENERGY LAB**	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

A wind turbine turns energy in the wind into electricity using the aerodynamic force created by the rotor blades, which work similarly to an airplane wing or helicopter rotor blade. When the wind flows across the blade, the air pressure on one side of the blade decreases. The difference in air pressure across the two sides of the blade creates both lift and drag. The student will be able to understand basic operation of wind turbine with all parameters.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand the performance curve of a wind turbine
2	To do power analysis of a wind turbine.
3	To understand the behavior of wind turbine controller with respect to the load(AC & DC).

COURSE OUTCOMES

On the successful completion of the laboratory course, students will be able to

CO1.Understand various characteristics of wind turbine with respect to V, I & P	Understand
CO2.Understand the concept of cut in and cut off speed.	Understand
CO3. Understand the performance of wind turbine at various frequencies.	Understand
CO4. Understand the concept of tip speed ratio.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO2	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO3	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-
CO4	S	S	S	M	L	-	M	-	M	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. *Evaluate the efficiency of charge controller used in the Wind Energy Training System (WETS).*
2. *Evaluate the cut-in speed of wind turbine experimentally.*
3. *Evaluate the Tip Speed ratio (TSR) at different wind speeds.*
4. *Draw the turbine Power versus wind speed curve.*
5. *Draw the curve between TSR and coefficient of power.*
6. *Draw the power curve of turbine with respect to the rotational speed of rotor at fix wind speeds.*
7. *Demonstrate the power analysis at turbine output (for high wind speeds).*
8. *Demonstrate the power analysis at different branches of wind turbine energy system (at high frequency) with AC load only.*
9. *Demonstrate the power analysis at different branches of wind turbine energy system (at high frequency) with AC load only.*
10. *Demonstrate the power analysis at different branches of wind turbine energy system (at high frequency) with DC load only.*

References

2. *Laboratory reference manual*

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	V.Rattan Kumar	AP(II)	EEE	rattankumar@avit.ac.in

17EESE83	POWER ELECTRONICS SIMULATION LAB -I	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course provides to get hands on practical knowledge on the equipment for power semi conductor devices and its characteristics, converters, drives.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To simulate and design various gate firing circuits.
2	To familiarize the students by introducing softwares like P- sim, Multisim, and help them to simulate and analyze different converters.
3	To enable the students to study & simulate circuits using Matlab software and on hardware kits.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Ability to design and conduct simulation and experiments.	Understand
CO2	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	Analyze and Create
CO3	Ability to identify, formulate & solve engineering problems with simulation.	understand
CO4	Ability to simulate characteristics of SCR, MOSFET, IGBT.	Analyze
CO5	Ability to simulate gate firing circuits	Analyze and Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M			L	L					L	S	M	S
CO2	S	M						L				M	S	L	S
CO3	S	M	L										S	M	S
CO4	S	M				M							S	M	S
CO5	S	M				L							S	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

STUDY EXPERIMENTS

1.Study of characteristics of SCR,TRIAC, DIAC
2.Study of Gate firing circuits

SIMULATION EXPERIMENTS

1.Characteristics of SCR, TRIAC, DIAC
2. Characteristics of power MOSFET, IGBT
3. Characteristics of UJT
4. Single Phase Half wave controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
5.Single Phase Half controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
6.Single Phase Full controlled converter with R,RL&RLE Load (for firing angles 30,60,90)with/without FD
7. Three Phase semi controlled converter with R,RL&RLE Load
8. Three Phase full controlled converter with R,RL&RLE Load

TEXT BOOKS

1 Laboratory Reference manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
1	P. LOGANATHAN	Assistant Professor	EEE	loganathan@vmkvec.edu.in

17EESE84	POWER ELECTRONICS SIMULATION LAB - II	Category	L	T	P	Credit
		SE	0	0	4	2

PREAMBLE

To provide hands on experience on the equipment for converters, inverters, choppers and simulation of closed loop control for electrical drives

PREREQUISITE : NIL

COURSE OJECTIVES

1	To design the simulation circuit for controlling the speed of DC and AC Motors
2	To design the simulation circuit and to analysis the performance of single phase, three phase half & full controlled rectifier
3	To simulate voltage and current commutated chopper
4	To design and run the simulation models of inverter and voltage controller
5	To design the simulation circuit for cycloconverter and to analyse the performance.

COURSE OUTCOMES

On the successful completion of the course ,students will be able to

CO1: Apply the appropriate technique to control the speed of AC and DC motors.	Apply
CO2: Analyze the performance of Chopper	Analyze
CO3: Design the simulation circuits for analyzing the performance of power electronics controllers	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PSO3
CO1	S	M	-	-	-	-	-	-	-	-		M	M	-	-
CO2	S	S	M	-	-	-	-	-	-	-	M	S	S	M	-
CO3	S	M	-	-	-	-	-	-	-	-		M	M	-	M

S-Strong,M-Medium, L-Low

LIST OF EXPERIMENTS

1. *Speed control of DC Shunt motor.*
2. *Speed control of PWM inverter fed three–phase induction motor.*
3. *Voltage commutated chopper.*
4. *Current commutated chopper.*
5. *Mc Murray – Bedford inverter.*
6. *AC voltage controller.*
7. *Series inverter.*
8. *Cycloconverter.*

Reference Books

Laboratory Reference manual

COURSE DESIGNERS

S.no	Name of the faculty	Designation	Department	Mail id
1	Mr.G.Ramakrishnaprabu	Associate Professor	EEE	ramakrishnaprabu@vmkvec.edu.in

17ATEC12	FUEL CELL TECHNOLOGY	Category	L	T	P	C
		EC(PS)	3	0	0	3

Preamble

New energy sources being worked out for automotive engines to replace conventional methods of using liquid fuels. Fuel cells are one of the promising sources in the development of electric vehicles in the present scenario.

Prerequisite

Nil

Course Objectives

1	To impart knowledge of various Fuel cell Technology as an option for automotive energy source.
2	To describe the vehicle structure for a fuel cell based energy source.
3	To detail on the various hybrid electric technology.
4	To explain hybrid electric vehicles.

Course Outcomes:

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

CO1.	Summarize on the various modes of fuel cell technology for automotive.	Understand
CO2.	Recommend a suitable structure for a fuel cell vehicle.	Apply
CO3.	Appraise on technology for developing hybrid powered vehicles.	Apply
CO4.	Appraise on the electric vehicle technology and its development.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	M	--	--	-	--	--	--	-	S	--	--
CO2	S	M	M	M	M	--	--	-	--	--	--	-	S	--	--
CO3	S	S	S	M	M	--	--	-	--	--	--	-	S	--	--
CO4	S	S	S	M	M	--	--	-	--	--	--	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

FUELCELL TECHNOLOGY
Structures, Operations and properties of Fuel cells – (Phosphoric Acid Fuel cell, Proton Exchange membrane Fuel cell, Direct Methanol fuel cell Alkaline Fuel Cells, Solid Oxide Fuel Cell, Molten Carbonate Fuel Cell) -Characteristics. Electrochemical energy conversion – Theoretical efficiency – Factors affecting electrochemical energy conversion- Helmholtz double layer model
FUEL CELL BASED VEHICLES STRUCTURE
PEMFC: Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly, impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications. DMFC: Operating principle – Noble metal issue – Electro-oxidation of methanol (Catalysts, oxygen electroreduction, electrolyte, non catalytic aspects) - Methanol crossover.
HYBRID ELECTRIC TECHNOLOGY AND ELECTRIC DRIVETRAIN
Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental impartance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.
HYBRID ELECTRIC VEHICLES
Principles of Hybrid Electric Drivetrains, Architectures – Electrical distribution, Hybrid control Strategies – Parallel Hybrid, Series Hybrid - (Charge Sustaining, Charge Depleting), Practical Models – Toyota Prius, Honda Insight. Hybridization Effects. 42 V System for Traction Applications - Lightly Hybridized vehicles, Low –Voltage Storage System, Low – Voltage main system with High voltage bus for propulsion. Heavy Vehicles Hybrid Electric Heavy Duty Vehicles, Fuel cell Heavy duty vehicles.
HYBRID VEHICLE TECHNOLOGY
Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems. Energy Management Strategies in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOK:

1. *Basu .S, "Recent Trends in Fuel cell Science and Technology", Anamaya Publishers, New Delhi.,2007*
2. *Viswanathan, B. and Aulice Scibioh, M., "Fuel Cells Principles and Applications", Universities Press (India) Pvt. Ltd., Hyderabad, 2006*
3. *Hoogers, G., Edr. "Fuel Cell Technology Handbook", CRC Press, Washington D. C,2003*

REFERENCES:

1. *Larminie, J. and Dicks, A., "Fuel Cell Systems Explained" John Wiley & Sons, Ltd., New York,2001.*
2. *Ali Emadi, Mehrdad Ehsani, John M. Muller, "Vehicular Electric Power Systems", Marcel Dekker,Inc., 2004*

CourseDesigners:

S.No	Name of the Faculty	Designation	Department/College	Mail ID
1	T.Raja	Associate Professor	Auto / VMKVEC	rajat@vmkvec.edu.in
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4	B. Samuvel Michael	Assistant. Professor GRII	Auto / AVIT	samuvelmichael@avit.ac.in

17CVEC18	WIND ENGINEERING	Category	L	T	P	C
		EC	3	0	0	3

PREAMBLE

The course includes studies of sustainable development and energy sources. Basic mathematical and physical concepts will be covered. An introduction to prerequisites for wind power development including how a wind turbine works, planning for wind energy, environmental impact, location and economic aspects will be given. The phases of wind power projects is studied. Oral and written presentations in a scientific context will be discussed and practiced in the course. A site study visit to an operating wind farm is included.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To learn about the forces generated on structures due to normal wind as well as gusts.
2	To analyse the dynamic effects produced due to chimney,tower and silos
3	To understand about the seismic design of various structures
4	To analyses the application in design and its implementations
5	To learn about the forces generated on structures due to normal wind as well as gusts.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Give an account of and analyse energy sources and their sustainability	Understand
CO2. Identify and explain a wind power project's phases	Apply
CO3. Identify and evaluate factors affecting wind energy development	Apply
CO4. Analyse the siting conditions for wind power development	Apply
CO5. Present an individual or group project of wind power.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	S	S	S	---	L	S	L	---	---	L	---	S	M	S
CO2	L	S	S	S	L	M	S	L	---	L	L	---	S	M	S
CO3	S	S	S	S	L	M	L	L	---	L	---	---	M	S	S
CO4	L	S	L	S	L	---	S	L	---	L	---	L	M	S	S
CO5	S	S	S	S	---	---	S	M	---	L	L	---	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION : Terminology – Wind Data – Gust factor and its determination - Wind speed variation with height – Shape factor – Aspect ratio – Drag and lift.

EFFECT OF WIND ON STRUCTURES : Static effect – Dynamic effect – Interference effects (concept only) – Rigid structure – Aeroelastic structure (concept only)..

EFFECT ON TYPICAL STRUCTURES : Tail buildings – Low rise buildings – Roof and cladding – Chimneys, towers and bridges

APPLICATION TO DESIGN : Design forces on multistorey building, towers and roof trusses.

INTRODUCTION TO WIND TUNNEL: Types of models (Principles only) – Basic considerations – Examples of tests and their use.

TEXT BOOKS:

1. Peter Sachs, "Wind Forces in Engineering, Pergamon Press, New York, 1992.
2. Lawson T.V., Wind Effects on Buildings, Vols. I and II, Applied Science and Publishers, London, 1993.

REFERENCE BOOKS:

1. Devenport A.G., "Wind Loads on Structures", Division of Building Research, Ottowa, 1990.
2. Wind Force on Structures – Course Notes, Building Technology Centre, Anna University, 1995

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.P.Sangeetha	Professor	Civil / AVIT	sangeetha@avit.ac.in
2	Dr.T.Subramani	Professor & Head	Civil / VMKVEC	tsm2007@rediffmail.com

17BMCC04	BIOMEDICAL INSTRUMENTATION & MEASUREMENTS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The variety of diagnostic, control, and monitoring equipment used for medical purposes comprises an array of biomedical instrumentation. These electronic systems can be used in a physician's office, a medical laboratory, or be implanted into a patient. This course is designed to acquire knowledge about the different components of various biomedical equipment and its working principle and to measure various physiological parameters.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To know about bioelectric signals, electrodes and its types.
2	To know the various Bio potential amplifiers.
3	To study about various Physiological measurements.
4	To study the recording of various cardiac signals.
5	To study about clinical laboratory instruments and blood cell counters.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explain the acquisition of various bio signals using various types of Electrodes.	Understand
CO2. Examine the different blood types of cell and usage of clinical laboratory instruments.	Apply
CO5. Use bio-amplifiers in medical applications.	Apply
CO3. Record and analyze various physiological signals.	Analyze
CO4. Classify various cardiac function measurements.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	--	--	--	L	--	--	--	--	--	M	--	--	--
CO2	S	M	M	S	--	M	--	L	M	--	--	M	M	--	--
CO3	S	M	M	S	--	M	M	L	M	--	--	M	M	M	--
CO4	S	M	S	M	--	M	S	M	S	--	--	S	S	S	M
CO5	S	M	S	M	--	M	S	M	S	--	--	S	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

BIOELECTRIC SIGNALS AND ELECTRODES

Basic medical instrumentation system, Origin of Bioelectric Potential – Resting and action potential, Nernst equation, Goldman equation. Recording electrodes – Electrodes: Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artefacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical conductivity of electrode jellies and creams, Types of electrodes.

BIO AMPLIFIERS

Bio amplifier, Need for Bio amplifier, Operational amplifier characteristics, Different modes of operation of differential amplifier, Basic operational amplifier circuits – Inverting, Non inverting, differential amplifier, Instrumentation amplifier. Chopper amplifier, Isolation Amplifier.

BIO SIGNALS RECORDING

ECG- Anatomy and Electrical conducting system of heart, Genesis of ECG, Einthoven triangle, Lead system, Segments and intervals of ECG, Normal and abnormal ECG wave forms, ECG Machine, Recording set up of EMG and EEG. Heart sounds and PCG, ERG, EOG.

CARDIAC FUNCTION MEASUREMENTS

Blood pressure measurement – direct and indirect method, Respiration rate measurement, Measurement of heart rate and pulse rate, Plethysmography technique. Blood flow measurement – electromagnetic, ultrasonic. Cardiac output measurement – Indication dilution method and dye dilution method

CLINICAL LABORATORY INSTRUMENTS AND BLOOD CELL COUNTERS

Spectrophotometer, colorimeter, flame photometer, auto-analyser. Types of blood cells, Methods of cell counting, coulter counters, automatic recognition and differential counting.

TEXT BOOKS:

1. Khandpur R.S, **“Hand-book of Biomedical Instrumentation”**, Tata McGraw Hill, 2nd Edition, 2003.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **“Biomedical Instrumentation and Measurements”**, Prentice-Hall India, 2nd Edition, 1997.
3. Arumugam, M, **“Biomedical Instrumentation”**, Anuradha publications, 2008.

REFERENCES:

1. John G. Webster, **“Medical Instrumentation Application and Design”**, John Wiley, 3rd Edition, 1997.
2. Carr, Joseph J, Brown, John.M **“Introduction to Biomedical Equipment Technology”**, John Wiley and sons, New York, 4th Edition, 1997.

COURSE DESIGNERS

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1	Dr. N.Babu	Professor	BME	babu@vmkvec.edu.in
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17CSCC01	DATA STRUCTURES	CATEGORY	L	T	P	CREDIT
		CC	3	0	0	3

PREAMBLE

This course aims at understanding the basic concepts in programming structures, linear structures and non linear structures

PRERQUISITE

NIL

COURSE OBJECTIVES

1.	To remember and understand the basic concepts in linear structures
2.	To learn about tree structures.
3.	To understand about balanced trees
4.	To learn about hashing and sets.
5.	To learn and understand about graphs

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Remember the basic concepts in linear structures	Understand
CO2. Learn about tree structures and tree traversals	Apply
CO3. Understand about balanced trees	Apply
CO4. Learn about hashing and sets.	Apply
CO5. Learn and understand about graphs	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	-	-	-	-	-	M	M	-	M
CO2	S	M	M	M	M	-	-	-	-	-	-	M	M	-	M
CO3	S	M	L	M	M	-	-	-	-	-	-	M	M	-	M
CO4	S	M	M	M	M	-	-	-	-	-	-	L	M	-	M
CO5	S	M	L	M	M	-	-	-	-	-	-	M	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

Linear Structures

Abstract Data Types (ADT) – List ADT – array-based implementation – linked list implementation – cursor-based linked lists – doubly-linked lists – applications of lists –Stack ADT – Queue ADT – circular queue implementation – Applications of stacks and queues.

Tree Structures

Tree ADT – tree traversals – left child right sibling data structures for general trees and graphs.

Balanced Trees

AVL Trees – Splay Trees – B-Tree - heaps – binary heaps – applications of binary Heaps **.**

Hashing and Set

Hashing – Separate chaining – open addressing – rehashing – extendible hashing -Disjoint Set ADT – dynamic equivalence problem – smart union algorithms – path compression – applications of Set.

Graphs

Definitions – Topological sort – breadth-first traversal - shortest-path algorithms –minimum spanning tree – Prim's and Kruskal's algorithms – Depth-first traversal – bi-connectivity – Euler circuits – applications of graphs.

TEXT BOOKS:

1. Mark A. Weiss, “Data Structures and Algorithm Analysis in C (2nd Edition), Pearson Education.

REFERENCES:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, Pearson Education, First Edition Reprint.
2. R. F. Gilberg, B. A. Forouzan, “Data Structures”, Second Edition, Thomson India, Edition

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. R. Jaichandran	Associate Professor	CSE	jaichandran@avit.ac.in
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17CVEC07	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To Understand basic concepts in Disaster Management
2	To Understand Definitions and Terminologies used in Disaster Management
3	To Understand the Challenges posed by Disasters
4	To understand Impacts of Disasters

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters.	Understand
CO2. Identify the potential deficiencies of existing buildings for Earthquake disaster and suggest suitable remedial measures.	Understand
CO3.Derive the guide lines for the precautionary measures and rehabilitation measures for Earthquake disaster.	Apply
CO4. Derive the protection measures against floods, cyclone, land slides	Apply
CO5. Understand the effects of disasters on built structures in India	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	L	-	-	-	-	-	-	-	-	L	-	-
CO2	M	M	L	L	-	M	-	-	-	-	-	-	L	-	-
CO3	S	M	S	M	-	L	-	M	-	-	-	-	M	L	-
CO4	S	M	S	-	L	-	-	-	-	-	-	-	M	L	-
CO5	L	L	-	L	-	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Natural and man-made hazards

RISK ASSESSMENT AND VULNERABILITY ANALYSIS: Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

DISASTER MANAGEMENT MECHANISM: Concepts of risk management and crisis management ; Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief

DISASTER RESPONSE: Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management ;Minimum Standards of Relief; Managing Relief; Funding.

DISASTER MANAGEMENT IN INDIA: Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans.

TEXT BOOKS:

1. *Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.*
2. *Carter, W. N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.*
3. *Chakrabarty, U. K. Industrial Disaster Management and Emergency Response, Asian Books Pvt. Ltd., New Delhi 2007.*

REFERENCES:

1. *Abarquez I. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner's Handbook, ADPC, Bangkok, 2004.*
2. *Goudie, A. Geomorphological Techniques, Unwin Hyman, London 1990.*
3. *Goswami, S. C. Remote Sensing Application in North East India, Purbanchal Prakesh, Guwahati, 1997.*
4. *Manual on Natural Disaster Management in India, NCDM, New Delhi, 2001.*
5. *Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.*
6. *National Policy on Disaster Management, NDMA, New Delhi, 2009.*
7. *Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.*

COURSE DESIGNERS

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2	Dr.D.S.Vijayan	Asst. Professor	Civil / AVIT	vijayan@avit.ac.in

17CSCC04	COMPUTER ARCHITECTURE	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE:
This course is dedicated to number system, logic design, and memory and processing. This is the only course that is concerned with the hardware of a computer, its logic design and organization. It aims at making the student familiar with digital logic and functional design of arithmetic and logic unit that is capable of performing floating point arithmetic operations.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To learn about the design of the processors.
2	To learn about the data transfer.
3	Understand the functional units of a computers, bus structures and addressing modes.
4	Apply the knowledge of algorithms to solve arithmetic problems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1 Explain about computer organization components.	Understand
CO2 Compute simple arithmetic operations for fixed-point and floating-point addition, subtraction, multiplication & division.	Apply
CO3 Design combinational and sequential digital functions.	Analyse
CO4 Construct an instruction set capable of performing a specified set of operations.	Analyze
CO5 Demonstrate a memory system for a given set of specifications	Analyze
CO6 Explain pipelining concepts	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	M	-	-	-	-	-	-	-	L	-	-	M
CO2	M	M	M	M	-	-	-	-	-	-	-	L	-	-	M
CO3	M	M	S	M	-	-	-	-	-	-	-	-	-	M	M
CO4	S	M	M		-	-	-	-	-	-	-	-	-	M	M
CO5	S	-	M	L	-	-	-	-	-	-	-	-	-	M	M
CO6	M	M	M	S	-	-	-	-	-	-	-	L	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Computer Organization- Main memory – CPU operation – Interrupt concept – I/ O techniques – Bus concept – Computer performance factors – System performance measurement- High performance techniques – Comparison of Architecture and Organization – Study of Salient features and architectures of Advanced processors (80286, 80386, 80486, Pentium).

PROCESSOR DESIGN AND CONTROL UNIT
Goals – Design process –Data path organization – Main memory interface – Data path for single instructions- Floating point unit data path – Role of control unit – Reset sequence – Interrupt recognition and servicing – Abnormal situation handling – Hardwired control unit – Micro programmed control unit.

MEMORY DESIGN & MEMORY MANAGEMENT

Memory types – Functional and usage modes – Memory allocation- Multiple memory decoding – Memory hierarchy – Instruction pre fetch – Memory interleaving – Write buffer – Cache memory –Virtual memory – Associative memory.

INTRA SYSTEM COMMUNICATION AND I/O

I/O controller & driver- Case study: Hard disk controller in IBM PC – I /O ports and bus concepts – Case study: Keyboard interface – Bus cycle – Asynchronous and Synchronous Transfer – Interrupt handling in PC – I/O techniques in PC – Case Study : RS 232 interface – Modern serial I/O interface – Bus arbitration techniques – Hard disk interface in PC.

ADVANCED ARCHITECTURE

Classification of parallelism – Multiple functional units – Pipelining – Vector computing – array processors –High performance architecture – RISC systems – Super scalar architecture – VLIW architecture – EPIC architecture – Multiprocessor systems – Cache coherence problem – Fault tolerance.

TEXT BOOKS:

1. William Stallings, "Computer Organization And Architecture – Designing For Performance", Sixth Edition, Pearson Education, 2007.

REFERENCES:

2. Govindarajulu, "Computer Architecture and Organization – Design principles and applications" , Tata McGraw Hill publications, New Delhi.
3. David A. Patterson And John L. Hennessy, "Computer Organization And Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann, 2013.
4. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
5. A.K.Ray & K.M.Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", McGraw-Hill Education (India), 2013 reprint.

COURSE DESIGNERS

S. No.	Name of the faculty	Designation	Department	Mail Id
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2.	Mrs. S.Leelavathy	Assistant. Professors (GII)	CSE	leelavathy@avit.ac.in

17CSCC19	INTERNET OF THINGS	Category	L	T	P	Credit
		CC	3	0	0	3

MBLE

dy and understand the technologies involved in Internet of Things (IoT) and apply them practically.

EQUISITE :NIL

RSE OBJECTIVES

1.	lerstand the basic concepts of IOT
2.	dy the methodology of IOT
3.	velop IOT applications using Raspberry PI
4.	velop IOT applications using Arduino and Intel Edison
5.	ply cloud concepts in IOT

RSE OUTCOMES

successful completion of the course, students will be able to

Able to understand basics in IOT	Understand
Able to understand Methodology in IOT	Apply
Able to design IOT applications using Raspberry	Analyze
Able to design IOT applications using Aurdino and Intel Edison	Analyze
Able to apply Cloud computing in IOT	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	PSO1	PSO2	PSO3
CO1	M	M	M	M	-	-	-	-	-	-	-	-	-	M	M
CO2	M	M	M	M	-	-	-	-	-	-	-	-	-	M	M
CO3	M	M	S	M	-	-	-	-	-	-	-	-	-	M	S
CO4	S	M	M	M	-	-	-	-	-	-	-	-	-	M	S
CO5	S	M	M	M	-	-	-	-	-	-	-	-	-	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M.
IOT METHODOLOGY
IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.
IOT WITH RASPBERRY
Bascis of Raspberry PI, Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services
IOT WITH AURDINO AND INTEL EDISON
Basics of Aurdino, Intel Edison with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks
APPLICATIONS
Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT.
TEXT BOOKS
1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015. **2.** Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
REFERENCES
1. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.R.Jaichandran	Assistant professor G-II	CSE	rjaichandran@avit.ac.in
2.	Dr.M. Nithya	Professor	CSE	nithya@vmkv@edu.in

17CSEC09	ETHICAL HACKING	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

To analyze the basic concepts of security and hacking process

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand Technical foundation of cracking and ethical hacking
2	To identify Aspects of security, importance of data gathering, foot printing and system hacking
3	To understand evaluation of computer security
4	To understand Practical tasks will be used to re-enforce and apply theory to encourage an analytical and problem based approach to ethical hacking
5	To discuss about security tools and its applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Identify and analyse the stages an ethical hacker requires to take in order to compromise a target system.	Understand
CO2: Identify tools and techniques to carry out a penetration testing.	Understand
CO3: Critically analyze security techniques used to protect system and user data.	Apply
CO4: Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.	Apply
CO5: To apply information security features in real time	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	-	-	-	-	S	-	-	-	M	M	-	M	M
CO2	M	M	S	M	-	-	-	-	-	-	L	M	-	S	M
CO3	M	M	M	M	-	M	-	L	-	-	L	-	-	M	S
CO4	M	S	M	-	-	M	-	-	-	M	-	M	-	M	M
CO5	M	M	-	-	S	M	-	L	-	-	M	M	-	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction to Hacking, Types of Hacking, Hacking Process, Security – Basics of Security- Elements of Security, Penetration Testing, Scanning, Exploitation- Web Based Exploitation. Simple encryption and decryption techniques implementation.

HACKING TECHNIQUES

Building the foundation for Ethical Hacking, Hacking Methodology, Social Engineering, Physical Security, Hacking Windows, Password Hacking, and Privacy Attacks, Hacking the Network, Hacking Operating Systems- Windows & Linux, Application Hacking, Footprinting, Scanning, and Enumeration. Implementing System Level Hacking- Hacking Windows & Linux.

WEB SECURITY

Evolution of Web applications, Web application security, Web Application Technologies- Web Hacking, Web functionality, How to block content on the Internet, Web pages through Email, Web Messengers, Unblocking applications, Injecting Code- Injecting into SQL, Attacking Application Logic. Check authentication mechanisms in simple web applications. Implementation of Web Data Extractor and Web site watcher. Implementation of SQL Injection attacks in ASP.NET.

WIRELESS NETWORK HACKING

Introduction to Wireless LAN Overview, Wireless Network Sniffing, Wireless Spoofing, Port Scanning using Netcat, Wireless Network Probing, Session Hijacking, Monitor Denial of Service (DoS) UDP flood attack, Man-in-the-Middle Attacks, War Driving, Wireless Security Best Practices, Software Tools, Cracking WEP, Cracking WPA & WPA-II. Implementation- Locate Unsecured Wireless using Net-Stumbler/ Mini-Stumbler.

APPLICATIONS

Safer tools and services, Firewalls, Filtering services, Firewall engineering, Secure communications over insecure networks, Case Study: Mobile Hacking- Bluetooth-3G network weaknesses, Case study: DNS Poisoning, Hacking Laws. Working with Trojans using NetBus.

TEXT BOOKS

1. Stuart McClure, Joel Scambray, George Kurtz, “Hacking Exposed 6: Network Security Secrets & Solutions”, Seventh edition, McGraw-Hill Publisher, 2012.
2. Kevin Beaver, “Hacking for Dummies” Second Edition, Wiley Publishing, 2007.
3. Dafydd Stuttard and Marcus Pinto, “The Web Application Hacker’s Handbook: Discovering and Exploiting Security Flaws” Wiley Publications, 2007.
4. Ankit Fadia, “An Unofficial Guide to Ethical Hacking” Second Edition, Macmillan publishers India Ltd, 2006.

REFERENCES

1. Hossein Bidgoli, “The Handbook of Information Security” John Wiley & Sons, Inc., 2005.

COURSE DESIGNERS

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17CSEC11	GREEN COMPUTING	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

To acquire knowledge to adopt green computing practices and To learn about energy saving practices

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To acquire knowledge to adopt green computing practices
2	To minimize negative impacts on the environment
3	To learn about energy saving practices
4	To learn about green compliance. And implementation using IT

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Explain the significance knowledge to adopt green computing practices	Understand
CO2: Design and develop the green asset used to minimize negative impacts on the environment	Apply
CO3: Identify an appropriate cooling technologies and infrastructure for optimizing the cost of data center operations	Apply
CO4: Make use of an knowledge about energy saving practices ,the impact of e-waste and carbon waste	Apply
CO5: Analyze about green compliance, implementation using IT and derive the case study.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	S	-	-	-	M	-	-	-	-	-	-	-	S
CO2	S	S	M	-	L	-	S	S	-	M	-	M	-	-	S
CO3	S	M	M	-	-	M	S	M	-	-	-	-	-	M	M
CO4	S	S	-	-	-	-	S	S	-	M	-	M	-	-	M
CO5	S	M	M	-	-	S	M	-	M	-	M	S	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS

Green IT Fundamentals: Business, IT, and the Environment – Benefits of a Green Data Centre - Green Computing:Carbon Foot Print, Scoop on Power–GreenITStrategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

GREEN ASSETS AND MODELING

Green Assets: Buildings, Data Centres, Networks, Devices, Computer and Earth Friendly peripherals, Greening Mobile devices – Green Business Process Management: Modelling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

GRID FRAMEWORK

Virtualizing of IT Systems – Role of Electric Utilities, Telecommuting, Teleconferencing and Teleporting – Materials Recycling – Best Ways for Green PC – Green Data Center – Green Grid Framework. Optimizing Computer Power Management, Systems Seamless Sharing Across. Collaborating and Cloud Computing, Virtual Presence.

GREEN COMPLIANCE

Socio-Cultural Aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, And Audits – Emergent Carbon Issues: Technologies and Future. Best Ways to Make Computer Greener.

GREEN INITIATIVES WITH IT and CASE STUDIES

Green Initiative Drivers and Benefits with IT - Resources and Offerings to Assist Green Initiatives. - Green Initiative Strategy with IT - Green Initiative Planning with IT - Green Initiative Implementation with IT - Green Initiative Assessment with IT. The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TEXT BOOKS

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence,CRC Press, June 2011
2. Carl Speshocky, ―Empowering Green Initiatives with IT ‖, John Wiley and Sons, 2010.

REFERENCES

1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: Steps for the Journey ‖, Shoff/IBM rebook, 2011.
2. John Lamb, ―The Greening of IT ‖, Pearson Education, 2009.
3. Jason Harris, ―Green Computing and Green IT- Best Practices on Regulations and Industry ‖, Lulu.com, 2008.

COURSE DESIGNERS

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17ECCC04	SIGNALS AND SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Signals and Systems arise in a wide variety of fields. These concepts and techniques associated with in areas of science and technology. Signals are functions of one or more independent variables contain information about the behavior or nature of some phenomenon. Signals vary continuous / discrete in time. Systems respond to particular signals by producing other signals (output) having some desired behavior. It introduces the students to analyze signals and systems and to design systems to enhance or restore signals that have been degraded in some way.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the various classifications of Continuous time and Discrete time Signals and Systems.
2	To learn about the spectral analysis of Periodic and Aperiodic Signals using Fourier series.
3	To impart the knowledge in analysis and characterization of the CT system through Laplace transforms.
4	To learn about the analysis and characterization of the DT system through Discrete Fourier Transforms and Z Transform.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Classify the type of signals and systems.	Understand
CO2. Determine the time and frequency domain characteristics of continuous time periodic and aperiodic signals with the properties of Fourier Series and Fourier transform respectively.	Apply
CO3. Find the response of a continuous time LTI System using convolution.	Apply
CO4. Determine the time and frequency domain characteristics of discrete time periodic and aperiodic signals using the properties of DTFT, DFT & Z-Transforms respectively.	Apply
CO5. Compute DFT and IDFT coefficients of a given discrete time sequence using Fast Fourier Transform algorithms.	Apply
CO6. Apply and characterize the causality and stability of Discrete LTI system using Z-Transforms.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	L	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	-	M	-	-	-	M	-	-	M	S	-	-
CO3	S	M	M	-	M	-	-	-	M	-	-	M	-	-	-
CO4	S	M	M	-	M	-	-	-	M	-	-	M	-	-	M
CO5	S	M	M	-	M	-	-	-	M	-	-	M	-	M	-
C06	S	S	M	-	M	-	-	-	M	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION OF SIGNALS AND SYSTEMS

Continuous time signals, Discrete time signals, Unit step, Unit ramp, Unit impulse – Representation of signals in terms of unit impulse, Classification of continuous time signals & Discrete time signals-Continuous time systems-Discrete time systems- Classification of continuous time systems and Discrete time systems.

ANALYSIS OF CONTINUOUS TIME SIGNALS

Fourier series analysis-Representation of Continuous time Periodic signals – Trigonometric and exponential-Spectral Properties of Periodic power signals - Properties of Continuous time Fourier series – Parseval's relation for power signals, Fourier transform analysis-Representation of Continuous time signals- Properties of Continuous time Fourier transform –Fourier transform of a Periodic function, Rayleigh's Energy theorem.

LTI CONTINUOUS TIME SYSTEM

Convolution Integral, Impulse response, Solution of Differential equation with initial conditions- Zero state response and Zero input response, Block diagram representation, Fourier methods for analysis, Laplace transform analysis.

ANALYSIS OF DISCRETE TIME SIGNALS AND SYSTEMS

Representation of sequences – Discrete Time Fourier Transform (DTFT) - Discrete Fourier Transform (DFT) and its properties –Fast Fourier Transform- FFT Algorithm, DIF & DIT-Z Transform-Inverse Z Transform, Unilateral Z-Transform

LTI DT SYSTEM

Convolution sum - Impulse response and properties of LTI systems - Difference equations - Z Transform analysis - System stability and causality - Frequency response - Block Diagram representation.

TEXT BOOKS:

4. Alan V.Oppenheim, Ronald W. Schafer, "Discrete time signal processing", Pearson education , 2nd edition, 2007.
5. John G. Proakis and Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Pearson Education, 4thEdition, 2007.

REFERENCE BOOKS:

1. B.P. Lathi, "Linear Systems & Signals", Oxford Press, Second Edition, 2009.
2. Rodger E Ziemer, William H. Tranter, D. Ronald Fannin, "Signals and Systems – continuous and Discrete", Pearson Education, 4th Edition, 2009.
3. Douglas K Linder, "Introduction to Signals and Systems",Mc-Graw Hill, 1st Edition, 1999.

COURSE DESIGNERS

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17ECCC15	ANALOG & DIGITAL COMMUNICATION	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course provides a thorough introduction to the basic principles of Analog and Digital Communications. It also deals with Analog and Digital Modulation techniques, Communication Transmitter & Receiver design, Baseband and Bandpass Communication Techniques, Noise Analysis and Multiplexing techniques.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To Understand the basic elements of analog communication system
2	To learn the basic concepts behind the transmission and reception of Angle Modulation
3	To impart the knowledge about Analog to Digital Transition Systems &Information Theory
4	To Analyze & design the performance of various digital carrier transmission.
5	To Apply the knowledge of Digital Communication circuits in various fields.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Interpret the various Analog communication systems.	Understand
CO2.Illustrate the principle and operation behind various Modulators , Demodulators in Analog communications	Apply
CO3. Apply different coding theory to estimate Entropy, Mutual information, Information rate etc.	Apply
CO4.Demonstrate the concept of various digital carrier modulation and determine their error probability.	Apply
CO5.Analyze the major classifications of spread spectrum techniques .	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	L	S	-	-
CO2	S	M	M	-	M	-	-	-	-	-	-	M	S	M	-
CO3	S	M	M	M	-	-	-	-	-	-	-	M	M	-	-
CO4	S	S	M	M	-	-	-	-	-	-	-	M	-	-	-
CO5	S	M	M	M	L	-	-	-	-	-	-	L	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Analog Communication Systems

Principles of Amplitude Modulation – AM Modulators- Double Side Band Suppressed Carrier Modulation, Single Side Band Modulation, Vestigial Side Band Modulation, AM Demodulators,AM transmitters-Low level & High level Transmitters, AM Receivers – TRF, Super Heterodyne Receiver, Double conversion AM receivers.

Angle Modulation: Transmission And Reception

Angle Modulation - FM and PM, Modulation Index, Frequency Modulators and Demodulators, Phase Modulators, FM transmitters- Direct & Indirect transmitters, Angle Modulation Vs Amplitude Modulation, FM Receivers, Frequency Vs Phase modulation.

Analog to Digital Transition Systems & Information Theory

Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Code Modulation, Sampling Rate, DPCM, Delta Modulation, Time Division Multiplexing, Information Theory- Uncertainty, Information and entropy, source coding theorem, Discrete Memoryless channels, Mutual Information, Channel capacity, Channel coding theorem.

Digital Transmission
Pulse Transmission – Inter Symbol Interference, Eye pattern, Digital carrier Modulation-Binary Amplitude Shift Keying, Binary Frequency Shift Keying, Binary Phase Shift Keying, QPSK, bit and baud rate, BER Analysis

Spread Spectrum Modulation
Pseudo noise sequences, Direct sequence Spread Spectrum with coherent BPSK, Frequency hop spread spectrum modulation, Multiple Access Techniques – Wireless Communication, TDMA and FDMA

TEXT BOOK:
1. Simon Haykin and Michael Moher, "Communication systems" John Wiley & Sons, Fifth Edition, 2016

REFERENCE BOOKS:
1. Simon Haykin and Michael Moher, "An Introduction to Analog and Digital Communications", John Wiley & Sons, second Edition, 2006.
2. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, PHI, 2002
3. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", Pearson Education, 2001.
4. B. Carlson, "Introduction to Communication systems", 3rd Edition, McGraw Hill, 1989

COURSE DESIGNERS

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1	Mr.B.Rajasekaran	Associate Professor	ECE	rajasekaran@vmkvec.edu.in
2	Mrs.S.Valarmathy	Associate Professor	ECE	valarmathy@vmkvec.edu.in
3	Mr.P.Subramanian	Associate Professor	ECE	subramanian@avit.ac.in

17ECCC17	FPGA SYSTEM DESIGN	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Field programmable devices are able to match the functional complexity of ASIC Devices such as PROM, PLDs (PLAs, PALs). PALs were widely used for glue logic and replaced SSI and MSI devices. Complex PLDs are hierarchical PLDs that connects smaller PLDs through a central programmable interconnect to enable the implementation of medium complexity digital circuits. Main feature of CPLDs are the wide decoding, but has a low register to logic ratio. CPLDs architecture is not scalable, due to the central switch used in connecting small PLD structures. Digital designs once built in custom silicon are increasingly implemented in field programmable gate arrays (FPGAs), but effective FPGA system design requires a understanding of new techniques developed for FPGAs. This course deals FPGA fabrics, introduces essential FPGA concepts, and compares multiple approaches to solving basic problems in programmable logic.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To analyze the design principle of synchronous and asynchronous circuits.
2	To design complex programmable logic by analyzing the FPGA architecture.
3	To know the functional operation of various components of FPGA logics.
4	To expertise in VHDL programming.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Analysis, Design and Optimisation of the sequential digital systems.	Understand
CO2. Illustrate the FPGA architecture- logic cell, I/O cell and interconnects	Analyze
CO3. Design Complex Programmable Logic Devices for specific applications	Analyze
CO4. Discriminate the functional operation of various components of FPGA logics	Analyze
CO5. Design new logical design using VHDL programming	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CO1	S	M	M	M	L	-	M	-	-	-	-	M	S	-	-
CO2	S	M	S	L	M	-	-	-	-	-	-	M	M	M	-
CO3	S	S	S	S	L	-	M	-	-	-	L	M	-	M	M
CO4	S	M	L	L	L	-	-	-	-	-	-	M	-	-	-
CO5	M	S	S	S	S	L	M	-	-	-	L	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

Sequential Circuit Design using state machine approach

Synchronous and Asynchronous Sequential Circuit -Finite State Machine- Moore and Mealy, State Diagram, State table, State Assignment, Optimization of sequential circuit – State Minimization – Determination of state equivalence using an implication table,Races and Hazards.

Programmable Logic to ASICs

Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs), the Masked Gate Array ASIC, CPLDs and FPGAs.

Complex Programmable Logic Devices

CPLD Architectures, Function Blocks, I/O Blocks, Clock Drivers, Interconnect CPLD Technology and Programmable Elements.

FPGA Systems

Basic Concepts, Digital Design and FPGAs, FPGA-Based System, VLSI Technology-Manufacturing Processes, Transistor Characteristics, CMOS logic gates, Wires, Registers and RAM, Packages and Pads, FPGA Fabrics-FPGA Architectures, SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabrics, Architecture of FPGA Fabrics

Hardware Description Language VHDL

Introduction to VHDL, structural, functional programming, Combinational Logic-Combinational Network Delay, Power and Energy Optimization, Arithmetic Logic, Logic Implementation for FPGAs, Physical Design for FPGAs, Sequential Machines-Sequential Design Styles, Rules for Clocking, Performance Analysis, Power Optimization.

TEXT BOOKS:

1. Charles H.Roth Jr, Larry L.Kinney "Fundamentals of Logic Design", Seventh edition, Cengage Learning 2014.
2. Jan M. Rabey, Anantha Chandrakasan and Borivoje Nikolic " Digital integrated circuits: A Design Perspective (2nd Edition) ", Pearson 2009

REFERENCE BOOKS:

1. Wayne Wolf "FPGA –Based System Design" Pearson Education, 2004.
2. Bob Zeidman, "Designing with FPGAs and CPLDs", Elsevier, CMP Books, 2002.
3. M. Morris Mano and Michael D. Ciletti, "Digital Design", PHI, fourth edition, 2008
4. R.F.Tinder: Engineering Digital Design, (2/e), Academic Press, 2000
5. Stephen Brown Zvonko Vranesic "Fundamentals of Digital Logic with VHDL Design" Tata McGraw-Hill Edition.

COURSE DESIGNERS

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3	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in
4	Mr. S. Selvam	Assistant Professor (Gr-II)	ECE	Selvam@avit.ac.in

17ECEC02	PCB & PLC	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

Printed circuit boards are inarguably one of the most influential inventions of the 20th century. Nearly every piece of technology today uses at least one of these devices, and they have played roles in historically significant events like world war II and space travels. To gain an appreciation for PCB technology, let's look at several significant moments in the history of circuit boards.

A Programmable Logic Controller (PLC) is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices.

PREREQUISITE NIL

COURSE OBJECTIVES

1	To Understand the need for PCB and electronics components.
2	To learn PCB layout design flow and Artwork generation.
3	To obtain knowledge in Etching Soldering and Assembly techniques.
4	To Understand the basic concept of PLC and basic programming.
5	To Earn Knowledge to deploy PLC for varies applications like Timers, Program counters etc.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Appreciate the necessity and evolution of PCB, types and classes of PCB.	Understand
CO2. Apply layout design rules and Artwork generations to prepare for PCB for any specific applications.	Apply
CO3. Interpret varies techniques used in Etching, Soldering process of PCB and components Assembling rules on PCB.	Apply
CO4. Develop varies I/O module, basic PLC programming and design varies types of memory.	Apply
CO5. Design Automation systems for industrial applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	-	S	-	-
CO2	S	M	M	-	M	-	-	-	M	-	-	M	-	M	-
CO3	S	M	M	-	M	-	-	-	M	-	-	M	-	M	M
CO4	S	M	M	-	M	-	-	-	M	-	-	M	-	M	-
CO5	S	M	M	-	M	-	-	M	M	-	-	M	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO PCB: Connectivity in electronic equipment, Evaluation of PCB, Components of PCB, Classification of PCB, Manufacturing of Basic PCB, Challenges in modern PCB Design, PCB with Embedded Components, standards of PCB and useful standards, Basics of Electronic Components – Active and Passive components, Special types of diodes, linear integrated circuits, semiconductor memories, surface mount devices.

LAYOUT PLANNING AND ARTWORK DESIGN: Drawing and diagrams, General PCB Design considerations, Mechanical design considerations, electrical design considerations, Component placement rules, Fabrication and assembly considerations, environmental factors, cooling requirements and packaging density, layout design, Layout design checklist, useful standards. Basic approach to manual Artwork, General design guidelines for Artwork preparations, Automated Artwork generations.

ETCHING, SOLDERING AND ASSEMBLY TECHNIQUES: Etching solutions and chemistry, Etching arrangements, Etching parameters, equipments and techniques, Problems in etching, Theory of soldering, Soldering variables, Soldering materials, Soldering and brazing, soldering tools and other hand soldering tools, PCB assembly process, Mass Soldering. Health and Safety aspects.

INTRODUCTION TO PLC: Programmable Logic Controllers (PLCs): Programmable Logic Controllers, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Application. PLC Hardware Components - The I/O Section , I/O Modules and Specifications, The CPU, Memory Design and Types, Programming Devices, Recording and Retrieving Data, PLC workstations. Basics of PLC Programming- Processor Memory Organization, Program Scan, PLC Programming Languages and Instructions, Entering the Ladder Diagram, Modes of Operation.

APPLICATIONS OF PLC: Programming Timers-Mechanical Timing Relay and Instructions, Retentive Timer, Cascading Timers. Programming Counters - Counter Instructions and types, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions, Program Control Instructions, PLC Installation Practices. Editing and Troubleshooting.

TEXT BOOKS:

1. Printed Circuit Boards: Design, Fabrication, Assembly and Testing by RS Khandpur, Tata McGraw Hill Education Pvt Ltd., New Delhi , 2018.
2. *Frank D. Petruzella, "Programmable Logic Controllers", McGraw-Hill Companies, Third Edition, March 2004.*

REFERENCE BOOKS:

1. Printed Circuit Boards: Design, Fabrication, and Assembly (McGraw-Hill Electronic Engineering-2006) by Raghbir Singh Khandpur
2. Ian G.Warnock, "Programmable Controller s Operation and Application", Prentice Hall International, UK, 1992.
3. Electronic Product Design Volume-I by S D Mehta, S Chand Publications
4. John W. Webb and Ronald A.Reis, "Programmable Logic Controllers – Principles and Applications", III Edition, Prentice Hall Inc., New Jersey, 1995.

COURSE DESIGNERS

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17ECEC04	DSP WITH FPGA	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE This course provides the students, the knowledge about implementation of Communication blocks on FPGA. It provides both the fixed point and floating point representation of data used for implementation. It considers algorithms and techniques for the optimal way of implementing the communication system blocks efficiently on FPGA.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To program FPGA device.
2	To discriminate floating point arithmetic for other arithmetic logic.
3	To implement FIR and IIR filters using pipelining and parallel processing
4	To design communication blocks using different types of FFT algorithms

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explore the design flow of FPGA and programming language.	Apply
CO2. Compute simple FPGA logic using floating point arithmetic, MAC and SOP units	Apply
CO3. Implement FIR and IIR Filters using distributed arithmetic, pipelining and/or parallel processing	Apply
CO4. Examine the different types of FFT algorithms including Cooley-Tukey, Winograd and Good-Thomas.	Analyze
CO5. Design communication blocks for modulation, demodulation, convolution codes	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	L	-	-	-	-	M	-	M	S	-	-
CO2	S	S	L	M	M	-	-	-	-	M	-	M	-	-	-
CO3	S	S	M	M	L	-	-	-	-	L	-	M	M	M	-
CO4	S	S	M	M	-	-	-	L	-	L	-	M	-	-	-
CO5	S	M	M	M	-	-	-	L	-	L	-	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

FPGA Technology

Introduction to FPGA, FPGA Design flow, Programming languages, programming technology

Basic Building Blocks

Number Representation, Binary adders, Binary dividers, Floating point arithmetic, MAC & SOP unit

Digital filter implementation

FIR filter - Theory and structure, Filter Design, Constant coefficient, FIR Design, IIR filter - IIR theory, Coefficient computation, Implementation detail, Fast IIR filter

Fourier Transform

DFT algorithms, Goertzel algorithm, Hartley transform, Winograd DFT, Blustein chirp−z transform, Rader algorithm, FFT algorithms, Cooley-tukey, Good thomas, Winograd FFT

Communication blocks

Error control codes, Linear block code, Convolution codes, Modulation and Demodulation, Adaptive filters, LMS, RLS, Decimator and Interpolator, High Decimation Rate filters.

TEXT BOOKS:

1. *Uwe.Meyer-Baese, ―Digital Signal Processing with Field Programmable Gate Arrays ‖, Springer, Third edition, May 2007.*
2. *Keshab K. Parhi, ―VLSI Digital Signal Processing systems, Design and implementation ‖, Wiley, Inter Science, 1999.*

REFERENCE BOOKS:

1. *John G. Proakis, ―Digital Communications, ‖ Fourth Ed. McGraw Hill International Edition, 2000.*
2. *Michael John Sebastian Smith, ― Applications Specific Integrated Circuits ‖, Pearson Education, Ninth Indian reprint,13th edition,2004.*
3. *Sophocles J. Orfanidis, ―Introduction to Signal Processing ‖, Prentice Hall, 1996*

COURSE DESIGNERS

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17ECEC06	MEMS AND SENSORS	Category	L	T	P	Credits
		EC (PS)	3	0	0	3

PREAMBLE

To gain basic knowledge on MEMS (Micro Electro Mechanical System). This enables them to design, analyze, fabricate and test the MEMS based components.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To understand the concepts of basic MEMS structures.
2	To learn about the various MEMS Sensors and its construction.
3	To learn about the micro machining products.
4	To understand the functioning of various optical MEMS Sensors.
5	To study the various applications of MEMS Sensors

Course Outcomes

On the successful completion of the course, students will be able to

CO1. Understand the basic fabrication of MEMS systems.	Understand
CO2. Design various MEMS sensors for required applications.	Apply
CO3.Apply the different micromachining process in MEMS sensor fabrication.	Apply
CO4. Analyze the light source utilization in MEMS sensors.	Analyze
CO5. Evaluate the various real time applications of MEMS Sensors.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	L	M	-	-	-	-	-	-	-	-	L	S	-	-
CO3	L	S	M	-	L	-	-	-	-	-	-	L	M	-	-
CO4	S	S	S	-	M	-	-	-	-	-	-	L	-	M	-
CO5	S	S	S	-	M	M	M	M	-	-	-	L	-	M	M

S – Strong; M – Medium; L – Low

SYLLABUS

INTRODUCTION

MEMS and Microsystems, Typical products of MEMS and Microsystem products, Micro sensors, Micro actuator, Evolution of Micro fabrication, Microsystems and Microelectronics, MEMS materials.

MICRO SENSORS AND MICROSYSTEMS

Micro sensors- Acoustic wave sensors, Biomedical Sensors and Biosensors, Optical Sensors, Pressure sensors, Micro actuation- Actuation using Thermal Forces, Piezoelectric Crystals, Electrostatic Forces, MEMS with Micro actuators- Micro grippers , Micro motors , Micro valves, Micro accelerometers.

PRINCIPLES OF MICROMACHINING

Introduction, Photolithography, Bulk Micromachining, Thin Film Deposition, Etching, surface Micromachining, LIGA

.

OPTICAL MEMS

Fundamental Principle of MOEMS Technology, Review Properties of Light, Light Modulators, Beam Spliotter, Micro lens, Micro mirrors, Digital Micro mirror Device (DMD),Light Detectors, Grating Light

Valve, Optical Switch.

REAL TIME UTILISATION OF MEMS SENSORS

Health Care, Micro fluid Dispenser, Micro needle, Micro pumps, Chem-Lab-On-A-Chip(CLOC), E-Nose, DNA sensors, Surface Acoustic Wave(SAW) Sensors.

TEXT BOOKS:

6. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002. Liu,"MEMS", Pearson education, 2000.
7. N. P. Mahalik, "MEMS",Tata McGraw hill, Sixth reprint, 2012.

REFERENCE BOOKS:

4. Stephen Santeria," Microsystems Design", Kluwer publishers, 2000.
5. Nadim Maluf," An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
6. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000

COURSE DESIGNERS

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17ECEC20	ROBOTICS AND AUTOMATION	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

Robotics is the applied science of motion control for multi-axis manipulators and is a large subset of the field of "Mechatronics" (Mechanical, Electronic and Software engineering for product or systems development, particularly for motion control applications). Robotics, sensors, actuators and controller technologies are continuously improving and evolving synergistically. In the 20th century, engineers have mastered almost all forms of motion control and have proven that robots and machines can perform almost any job that is considered too heavy, too tiring, too boring or too dangerous and harmful for human beings. This course supports the students to design and develop multi-DOF manipulator and wheeled mobile robot.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To Understand the actuators used in robotic manipulators and indicate their advantages and limitations.
2	To apply the forward kinematic model of multi-degree of freedom to develop a robot arm and wheeled robot
3	To apply a static force and dynamic model of two degrees of freedom to develop robot arm
4	To apply a step by step procedure for the generation a cubic polynomial trajectory for a joint with specified kinematic constraints
5	To apply and develop a program for point-to-point applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe the working of the subsystems of robotic manipulator and wheeled mobile robot	Understand
CO2. Demonstrate the forward kinematic model of multi-degree of freedom (DOF) manipulator and inverse kinematic model of two and three degrees of freedom planar robot arm and wheeled robot	Apply
CO3. Exhibit the static force and dynamic model of two degrees of freedom planar robot arm	Apply
CO4. Organize a trajectory in joint space using polynomial and trigonometric functions with given kinematic constraints of multi-degree of freedom (DOF) manipulator	Analyze
CO5. Experiment a offline robot program for point-to-point applications such as pick and place, palletizing, sorting and inspection of work-parts	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	-	M	-	-	M	-	-	-
CO2	S	M	M	-	-	-	-	-	M	-	-	M	M	M	-
CO3	S	M	M	-	-	-	-	-	M	-	-	M	-	-	-
CO4	S	M	M	-	M	-	-	-	M	-	-	M	M	-	-
CO5	S	M	M	-	M	-	-	-	M	-	-	M	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Robotics. Mechanical structure: Robot Configuration - Robot Anatomy, Sub-systems/ Elements of Industrial Robot - Performance characteristics of industrial Robots. Mobile robot locomotion: Introduction, key issues for locomotion, wheeled locomotion-wheel design, geometry, stability, manoeuvrability and controllability. Applications - Progressive advancement in Robots – Point to point and continuous motion applications - Mobile manipulators and its applications.

Kinematic model: Forward Kinematics for two DOF manipulator – Algebraic method, Mechanical structure and notations, Coordinate frames, Description of objects in space, Transformation of vectors, Fundamental rotation matrices (principal axes and fixed angle rotation) Description of links and joints, Denavit-Hartenberg (DH) notation, Forward Kinematics for multi-Degrees of Freedom (DOF) manipulator. Inverse kinematics of two DOF planar manipulator - Manipulator workspace. Mobile Robot kinematics: kinematic model and constraints, Mobile robot workspace-motion control.

Static model: Differential relationship - Velocity analysis – Jacobian matrix – Determination of forces and equivalent torques for joints of two link planar robot arm. Dynamic model: Euler –Lagrangian formulation - Forward and inverse dynamic model for two DOF planar manipulator.

Trajectory planning: Definitions and planning tasks, Joint space techniques – Motion profiles – Cubic polynomial, Linear Segmented Parabolic Blends and cycloidal motion - Cartesian space techniques. Navigation: Graph search and potential field path planning - navigation architecture - offline and online planning.

Robot Programming- Manual Programming – Teach Pendant, Offline programming - VAL programming, Online Programming. Case Studies.

TEXTBOOKS

7. *S.K.Saha, "Introduction to Robotics", Second Edition, McGraw Hill Education (India) Private Limited, 2014.*
8. *Roland Siegwart and Illah R.Nourbakhsh, "Introduction to Autonomous Mobile Robots", Prentice Hall of India (P) Ltd., 2005.*

REFERENCE BOOKS

7. B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, "Robotics: Modelling, Planning and Control", First Edition, Springer-Verlag London,2009
8. K.S. Fu, R.C Gonzalez and C.S. Lee, "Robotics- Control, Sensing, Vision and Intelligence", Tata McGraw-Hill Editions, 2008.
9. John J.Craig, "Introduction to Robotics, Mechanics and Control", Third Edition, Pearson Education, 2005.
10. Mark W.Spong, M.Vidyasagar, "Robot Dynamics and Control", Wiley India, 2009.
11. George A. Bekey, "Autonomous Robots – From Biological Inspiration to Implementation and Control", MIT Press, 2005.
12. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, "Principles of Robot Motion – Theory, Algorithms and Implementation", MIT Press, 2005.
13. Mikell P. Groover, Mitchell Weiss, Roger N.Nagel and Nicholas G. Odrey, "Industrial Robotics – Technology, Programming and Applications" Tata McGraw-Hill, 2008.
14. Yoram Koren, "Robotics for Engineers", McGraw-Hill Book Co., 1992.
15. P.A. Janakiraman, "Robotics and Image Processing", Tata McGraw-Hill, 1995.

COURSE DESIGNERS

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17MECC03	ENGINEERING MECHANICS	Category	L	T	P	Credit
		CC	2	1	0	3

Preamble

This course provides the basic knowledge about the behaviour of the bodies which are under static and dynamic conditions.

Prerequisite

NIL

Course Objective

1	To explain the basic laws of mechanics and forces
2	To relate the basic concepts and application of rigid bodies under equilibrium in two dimension
3	To solve the problems related to properties of surfaces and solids
4	To solve problems involving Friction and Rigid body dynamics.
5	To analyze the dynamics of particles problems.

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

CO1.	Identify the engineering problems using the concept of static equilibrium	Understand
CO2.	Solve problems of rigid bodies under equilibrium in two dimension	Apply
CO3.	Determine the Centroid, moment of inertia and mass moment of inertia of various sections.	Apply
CO4.	Solve frictional and rigid body application problems.	Apply
CO5.	Analyze engineering systems using the concept of dynamic equilibrium	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	L	-	-	-	-	-	-	L	-	
CO2	S	s	M	M	-	M	-	-	-	-	-	-	L	-	
CO3	S	M	M	M	-	M	-	-	-	-	-	-	L	-	
CO4	S	S	M	M	-	L	-	-	-	-	-	-	L	-	
CO5	S	S	L	S	-	S	-	-	-	-	-	-	L	-	

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS & STATICS OF PARTICLES

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem. Parallelogram and triangular law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

EQUILIBRIUM OF RIGID BODIES
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension.
PROPERTIES OF SURFACES AND SOLIDS
Determination of Areas and Volumes - First moment of area - centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Mass moment of inertia.
FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS
Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.
DYNAMICS OF PARTICLES
Displacement, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy equation of particles - Impulse and Momentum - Impact of elastic bodies.

Text Books	
1	Beer & Johnson, Vector Mechanics for Engineers. Vol. I Statics and Vol. II Dynamics, McGraw Hill International Edition, 1995.
2	Kottiswaran N, Engineering Mechanics-Statics & Dynamics, Sri Balaji Publications,2014.
3	Meriam, Engineering Mechanics, Vol. I Statics & Vol. II Dynamics 2/e, Wiley Intl., 1998.
Reference Books	
1	Rajasekaran.S, and Sankara Subramanian G, "Engineering Mechanics", Vikas Publishing Co. New Delhi.
2	Irving H. Shames and G.Krishna Mohana Rao, Engineering Mechanics - Statics & Dynamics, 4th Edition, Prentice Hall of India Pvt. Ltd., 1997.
3	K.L.Kumar, Engineering Mechanics III Edition, Tata McGraw Hill Publishing Co. Ltd., 1998

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2	A Elanthiraiyan	AP-II	MECH/AVIT	aelanthirayan@avit.ac.in

17CVCC34	FLUID MECHANICS AND MACHINERY	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

The aim of the subject is to provide a fundamental knowledge in fluid mechanics and machinery.

Prerequisite : NIL

Course Objective

1	To learn the fundamentals in Fluid Mechanics
2	To understand the kinematics of the fluid flow.
3	To understand the fluid flow concepts
4	To learn the working principle, applications & design of various hydraulic turbines.
5	*To learn the working principle, applications &, design of various hydraulic pumps.*

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

CO1.	Determine the variation of pressure in fluid at rest and calculate the hydrostatic forces and point of application on a plane or curved surface.	Apply
CO2.	Distinguish between various types of flows and derive the continuity equation for compressible and incompressible flow	Apply
CO3.	Understand the use and limitations of the Bernoulli's equation and apply it to solve a variety of fluid flow problems.	Apply
CO4.	Describe the condition under which the flow in a circular pipe is laminar or turbulent	Apply
CO5.	Estimate the major and minor losses in pipe flow and calculate the flow through pipes connected in series and in parallels	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	S	M	M	L	M	L	-	-	-	-	-	L	L	M	L
CO2	S	M	M	L	L	L	-	-	-	-	-	M	L	M	L
CO3	S	M	M	L	L	L	-	-	-	-	-	L	L	M	L
CO4	S	S	S	M	L	L	-	L	-	-	L	M	L	L	L
CO5	M	M	M	L	L	M	-	-	-	-	L	M	L	L	L

S- Strong; M-Medium; L-Low

SYLLABUS
BASIC CONCEPTS AND PROPERTIES
Fluid – Definition - solid and fluid - Units and dimensions - Properties of fluids – Temperature - Viscosity - Compressibility - Vapour pressure - Capillary and surface tension - Fluid statics: concept of fluid static pressure - Pressure measurements by manometers and pressure gauges. Introduction to CFD, geophysical fluid dynamics. Velocity and density measurement methods.
FLUID KINEMATICS AND SIMILARITIES
Fluid Kinematics - Flow visualization - Lines of flow - Types of flow - Velocity field and acceleration - Continuity equation (one and three dimensional differential forms)- Equation of streamline - Stream function - Velocity potential function - Circulation - Flow net – Fluid dynamics - Equations of motion - Euler's equation along a streamline - Bernoulli's equation – Applications - Venturi meter - Orifice meter - Pitot tube - Dimensional analysis - Buckingham's π theorem- Applications - Similarity laws and models.
INCOMPRESSIBLE FLUID FLOW
Viscous flow - Navier-Stoke's equation - Shear stress - Pressure gradient relationship - Laminar flow between parallel plates - Laminar flow through circular tubes (Hagen poiseulle's) - Hydraulic and energy gradient - Flow through pipes - Darcy - Weisbagh's equation - Pipe roughness -Friction factor- Moody's diagram - Minor losses - Flow through pipes in series and in parallel - Power transmission - Boundary layer flows - Boundary layer thickness - Boundary layer separation - Drag and lift coefficients. Major losses-design aspect in application of drags and lift coefficients. Piping Engineering-Introduction and Applications.
HYDRAULIC TURBINES
Fluid machines: definition and classification - Exchange of energy - Euler's equation for turbo machines - Construction of velocity vector diagrams - Head and specific work - Components of energy transfer - Degree of reaction. Hydro turbines: definition and classifications - Pelton turbine - Francis turbine - propeller turbine - Kaplan turbine - Working principles - Velocity triangles - Work done - Specific speed - Efficiencies - Performance curve for turbines. Energy saving design requirements for turbine.
HYDRAULIC PUMPS
Pumps: definition and classifications - Centrifugal pump: classifications - Working principle- velocity triangles - Specific speed - Efficiency and performance curves - Reciprocating pump: classification - Working principle - Indicator diagram -Work saved by air vessels and performance curves - Cavitations in pumps - Rotary pumps- Applications.

Text Books

1	Bansal- R.K. - “Fluid Mechanics and Hydraulics Machines”- (5th edition) - Laxmi publications (P) Ltd- New Delhi- 2005.
2	Modi.P.N. & Seth.S.M., a Textbook on Fluid Mechanics, Standard Publishers Ltd.

Reference Books

1	White- F.M. - “Fluid Mechanics”- Tata McGraw-Hill- 5th Edition- New Delhi- 2003.
2	Ramamurtham. S- "Fluid Mechanics and Hydraulics & Fluid Machines"-Dhanpat Rai & Sons, Delhi- 2003.

Course Designers

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17MECC16	INDUSTRIAL AUTOMATION	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

To introduce the need, evolution, and motivation for Industrial Automation. Familiarization with basic concepts and different automation strategies being used in practice worldwide.

Prerequisite NIL

Course Objective

1	To explain the factory automation and integration
2	To Illustrate about hydraulics and pneumatics circuits
3	To Design the various design of pneumatic and electro-pneumatic circuits
4	To design about PLC and its applications
5	To illustrate the automation in transfer machines & assembly.

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

CO1.	Explain the factory automation, production system and integration technologies in manufacturing sector	Understand
CO2.	Explain the various Hydraulics and Pneumatics Elements used for the industrial applications	Understand
CO3.	Develop the pneumatic and electro-pneumatic circuits for the given applications using standard procedures.	Apply
CO4.	Develop PLC for modern manufacturing applications using standard procedures	Apply
CO5.	Construct the automatic transfer machines & assembly automation	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	-	-	-	-	-	-	-	-	-	-	-	M	-	-
CO3	S	L	L	L	M	-	-	-	-	-	-	-	M	-	-
CO4	S	L	S	L	M	-	-	-	-	-	-	-	M	-	-
CO5	S	L	M	M	M	-	-	-	-	-	-	-	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FACTORY AUTOMATION AND INTEGRATION

Basic concepts and scope of industrial automation, socio-economic considerations, modern developments in automation in manufacturing and its effect on global competitiveness.-Need and implications of automation in manufacturing- Different types of production systems and automation-Hard/fixed automation

INTRODUCTION TO HYRDAULICS AND PNEUMATICS

Basic elements of hydraulics and pneumatics, electro-pneumatic controls and devices, electro-pneumatic systems, fluid power control elements and standard graphical symbols for them, construction and performance of fluid power generators, hydraulic and pneumatic actuators, their design and control devices-Sequence operation of hydraulic and pneumatic actuators-Applications in manufacturing- Hydraulic & pneumatic valves for pressure, flow & direction control, servo valves and simple servo systems with mechanical feedback, solenoid-Different sensors for hydraulic, pneumatic & electro-pneumatic systems.

DESIGN OF PNEUMATIC AND ELECTRO-PNEUMATIC LOGIC CIRCUITS

Logic circuits to be designed for a given time displacement diagram or sequence of operation-Pneumatic safety and control circuits and their applications to clamping, traversing and releasing operations.

PROGRAMMABLE LOGIC CONTROLLERS (PLC)

PLC for design demonstration, programming and interface the hardware with software for modern manufacturing applications.

AUTOMATIC TRANSFER MACHINES & ASSEMBLY AUTOMATION

Classifications, analysis of automated transfer lines, without and with buffer storage, group technology and flexible manufacturing system- Types of assembly systems, assembly line balancing, performance and economics of assembly system.

Text Books

1	Esposito, A., 2000. *Fluid power with applications*. Upper Saddle River: Prentice-Hall International.
2	Majumdar, S.R., 1996. *Pneumatic systems: principles and maintenance*. Tata McGraw-Hill Education.
3	Bolton, W., 2003. *Mechatronics: electronic control systems in mechanical and electrical engineering.* Pearson Education.

Reference Books

1	Auslander, D.M. and Kempf, C.J., 1996. *Mechatronics: mechanical systems interfacing*. Prentice Hall. .
2	Deppert, W. and Stoll, K., 1975. *Pneumatic Control*. Vogel.
3	Merritt, H.E., 1991. *Hydraulic control systems*. John Wiley & Sons.

Course Designers

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17MESE30	DESIGN OF THERMAL POWER EQUIPMENTS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This course provides knowledge of design and analysis of the heat exchangers.

Prerequisite

Thermal Engineering & Heat and Mass trnasfer

Course Objective

1	To provide the knowledge of heat transfer equipment.
2	To provide knowledge on design and analysis of the Shell and tube heat exchanger
3	Enable to carry out the performance of heat exchanger with the extended surfaces.
4	To provide design and analysis of cooling towers.

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

CO1.	Understand the basics of the heat exchangers.	Understand
CO2.	To understand the types and various parameters related heat exchangers.	Understand
CO3.	To interpret the performance of heat exchanger	Understand
CO4.	To synthesis and develop the Shell & tube heat exchanger.	Apply
CO5.	To design and analyze the cooling towers	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L		M			L						S	M	L
CO2	S	M											S	M	L
CO3	S	M					M						S	M	L
CO4	S	M		M			L						S	M	L
CO5	S	M		S	M		L						S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION OF HEAT EXCHANGERS

Introduction, Recuperation & Regeneration – Tubular heat exchangers: double pipe, shell & tube heat exchanger, Plate heat exchangers.

BASIC DESIGN METHODS OF HEAT EXCHANGER

Introduction, Basic equations in design, Overall heat transfer coefficient – LMTD method for heat exchanger analysis – parallel flow, counter flow, multi-pass, cross flow heat exchanger design calculations.

SHELL & TUBE HEAT EXCHANGERS

Tube layouts for exchangers, baffle Heat exchangers, calculation of shell and tube heat exchangers – shell side film coefficients, Shell side equivalent diameter, the true temperature difference in a 1-2 heat exchanger, shell side pressure drop, tube side pressure drop, Analysis of performance of 1-2 heat exchanger, and design calculation of shell & tube heat exchangers.

CONDENSATION OF SINGLE VAPORS AND EXTENDED SURFACES

Evaporators and Reboilers, Vaporizing processes, forced circulation vaporizing exchangers, natural circulation vaporizing exchangers, calculations of a reboiler.
Longitudinal fins, calculation of a double pipe fin efficiency curve, calculation of a double pipe finned exchanger.

DIRECT CONTACT HEAT EXCHANGER

Cooling towers, relation between wet bulb & dew point temperatures, classification of cooling towers, cooling tower internals, Heat balance, heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements. Calculation of cooling tower performance.

Text Books

1	Process Heat Transfer – D.Q. Kern, TMH.
2	Heat Exchanger Design – A.P.Fraas and M.N. Ozisick. John Wiely & sons, New York.

Reference Books

1	W.F. Stoecker, Design of Thermal Systems - McGraw-Hill
2	Bejan, G. Tsatsaronis, M.J. Moran, Thermal Design and Optimization – Wiley
3	N.V. Suryanarayana, Design & Simulation of Thermal Systems – MGH.

Course Designers

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1	Mr. N. Fedal Castro	Asst Prof - II	Mech / AVIT	fedal@avit.ac.in
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17MEEC11	INDUSTRIAL ROBOTICS	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

To study the application of industrial robots and enhance the knowledge of students in industrial applications

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand the Robotics and Robot drive system.
2	To Identify the controlling of Robots and devices system.
3	The Evaluate the latest technology of sensors used in robotics.
4	To classify the robot kinematics system.
5	To justify Application of robotics in industry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.	Understand the basics of Robot and its drive system.	Understand
CO2.	To Identify the steps involved in controlling system	Apply
CO3.	Demonstrate the various kinematics system used in robots.	Apply
CO4.	Demonstrate the various sensors used in robots.	Apply
CO5.	Apply the robot in day to day applications	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	M	M	M					S	M		M
CO2	S	M	M	S	M	M	M					S	M		S
CO3	S	S	S	S	M	M	M					S	S		S
CO4	S	M	M	M	S	M	M					S	S		S
CO5	S	S	S	S	S	S	S					S	S		S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION :

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems Hydraulic, Pneumatic and Electric system Functions – Need for Robots – Different Applications.

END EFFECTORS AND ROBOT CONTROLS:

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions, Adaptive control.				
ROBOT KINEMATICS:				
Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems.				
ROBOT SENSORS:				
Sensor -principles and applications of the following types of sensors – Position of sensors (Piezo electric sensor, LVDT, Resolvers, Optical encoders, Pneumatic position sensors) – Range sensors (Triangulation principle, Structured, Lighting approach, Time of flight range finders, Laser range meters) – Proximity sensors (Inductive, Hall effect, Capacitive, Ultrasonic and Optical proximity sensors) – Touch sensors (Binary sensors, Analog sensors) – Wrist Sensors – Compliance Sensors – Slip Sensors.				
INDUSTRIAL APPLICATIONS :				
Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.				
TEXT BOOKS:				
1	K.S. Fu, R.C. Gonzalez, C.S.G. Lee, “Robotics – Control Sensing, Vision and Intelligence”, Tata McGraw-Hill Education.			
2	Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012			
REFERENCES:				
1	*Kozyrey, Yu. “Industrial Robotics” MIR Publishers Moscow.*			
2	Richard D.Klafter, Thomas A. Chmielewski and Michael Negin, “Robotic Engineering-An Integrated Approach”,Prentice Hall Inc,Englewoods Cliffs,NJ,USA			
COURSE DESIGNERS				
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17MEEC13	INDUSTRIAL SAFETY	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

Preamble

To familiarize with safety issues in design, handling and industrial environment including the safety aspects and various laws associated with industrial safety.

Prerequisite

NIL

Course Objective

1	*To understand about safety management and understand all the safety aspects thoroughly.*
2	*To understand the various safety procedures and precaution to be followed during the operation of different types of machines.*
3	*To apply thoroughly equipped with sufficient knowledge of handling the different types of equipments and materials used for industrial safety.*
4	*To analyze the sufficient knowledge and sharing of expertise for emergency situations arising due to accidents and monitoring of health aspects.*
5	*To analysis of the various laws regarding health issues and safety of personals.*

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

CO1.	Explain the safety concepts and role of safety management.	Understand
CO2.	Discuss various safety aspects associated with operational safety of equipments like boilers, pressure vessels and other machineries used in workshop.	Understand
CO3.	Apply various safety measures to be undertaken with respect to industrial safety.	Apply
CO4.	Illustrate the various strategies to prevent accidents and implementation.	Analyze
CO5.	Outline the implementation of safety standards and the various laws related to safety, health and welfare of personnel.	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	L	-	-	-	-	-	-	-	-	L	-	-
CO2	S	L	L	L	-	-	-	-	-	-	-	-	L	-	-
CO3	S	M	M	L	-	-	-	-	-	-	-	-	L	-	-
CO4	S	M	M	L	-	-	-	-	-	-	-	-	L	-	-
CO5	S	M	M	L	-	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I - SAFETY MANAGEMENT

Evaluation of modern safety concepts - Safety management functions – safety organization, safety department – safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

UNIT II: OPERATIONAL SAFETY

Hot metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation – electroplating-hot bending pipes -Safety in welding and cutting. Cold-metal Operation –
Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting –shot blasting, grinding, painting - power press and other machines

UNIT III: SAFETY MEASURES

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety – Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on- site and off site. Control of major industrial hazards.

UNIT IV: ACCIDENT PREVENTION

Human side of safety - personal protective equipment - Causes and cost of accidents.
Accident prevention programs -Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting,
Investigation.

UNIT V SAFETY, HEALTH, WELFARE & LAWS

Safety and health standards - Industrial hygiene - occupational diseases prevention –
Welfare facilities - History of legislations related to Safety-pressure vessel act-Indian
Boiler act - The environmental protection act - Electricity act - Explosive act.

Text Books

1	Krishnan N.V. “Safety Management in Industry” Jaico Publishing House
2	Handlin.W, “Industrial Hand Book”, McGraw-Hill, 2000.

Reference Books

1	Heinrich.H.W, “Industrial Accident Prevention”, McGraw-Hill, 1980.
2	Rudenko.N, “Material Handling Equipments”, Mir Publishers, Moscow, 1981.
3	Lees.F.P, “Loss “Prevention in Process Industries”, Butterworths, New Delhi, 1986.
4	Accident Prevention Manual for Industrial Operations”,N.S.C.Chicago, 1982

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17ATEC02	NEW GENERATION AND HYBRID VEHICLES	Category	L	T	P	C
		EC	3	0	0	3

Preamble

To teach the students about the new generation and hybrid vehicles

Prerequisite

Nil

Course Objectives

1	To elucidate different modes of hybrid vehicles in current scenario.
2	To describe the different modes of power system for new generation vehicles .
3	To understand the operation and control of modern vehicle.
4	To detail the roads, highways and automated tracks for next generation automotive.
5	To explain the advanced technology in braking systems, suspension, aerodynamics and safety.

Course Outcomes:

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

CO1.	Discuss the various methods of developing hybrid vehicle technology available in the present scenario.	Understand
CO2.	Apply an appropriate power system for a new generation vehicle	Apply
CO3.	Apply a right choice of source of power for a modern vehicle	Apply
CO4.	Appraise about the roads, highways and automated tracks for next generation automotive.	Analyze
CO5.	Analyze and apply the exact method braking, suspension and safety .	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO2	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO3	S	M	M	M	M	--	--	-	--	--	--	-	S	--	--
CO4	S	S	S	S	S	--	--	-	--	--	--	-	S	--	--
CO5	S	S	S	S	S	--	--	-	--	--	--	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION TO HYBRID ELECTRIC VEHICLES
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance.
HYBRID ELECTRIC DRIVE-TRAINS
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis
ELECTRIC PROPULSION UNIT
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives
ENERGY STORAGE
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices
SIZING THE DRIVE SYSTEM
Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power, selecting the energy storage technology,

TEXT BOOK:

1. Bosch Hand Book, SAE Publication, 2010
2. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003

REFERENCES:

1. *James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.*
2. *Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.*

CourseDesigners:

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17ATEC04	SPECIAL TYPES OF VEHICLES	Category	L	T	P	C
		EC	3	0	0	3

Preamble

This course reviews the fundamental concepts of earth moving equipments, power train concepts, sub systems of special types of vehicles, farm equipment, military and combat vehicles and special purpose vehicles for industrial applications.

Prerequisite

Nil

Course Objectives

1	To detail the working of earth moving and constructional equipments
2	To describe power train concepts
3	To explain the sub systems of special types of vehicles
4	To describe the working of farm equipments, military and combat vehicles
5	To explain the working of special purpose vehicles for industrial applications

Course Outcomes:

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

CO1.	Describe the construction and working of earth moving and constructional equipments	Understand
CO2.	Appraise on the power trains applicable for for earth moving and constructional equipments.	Apply
CO3.	Appraise on the function of all the sub-systems for earth moving and constructional equipments.	Apply
CO4.	Appraise on the various farm equipments and military vehicles.	Apply
CO5.	Appraise on the various specially designed vehicles for industrial applications.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO2	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO3	S	S	S	M	--	--	--	-	--	--	--	-	S	--	--
CO4	S	S	S	M	--	--	--	-	--	--	--	-	S	--	--
CO5	S	S	S	M	--	--	--	-	--	--	--	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

CLASSIFICATION AND REQUIREMENTS OF OFF ROAD VEHICLES
Construction layout, capacity and applications. Power Plants, Chassis and Transmission, Multivalve vehicles.
EARTH MOVING MACHINES
Earthmovers like dumpers, loaders - single bucket, Multi bucket and rotary types- bulldozers, excavators, backhoe loaders, scrappers, drag and self powered types, Bush cutters, stumpers, tree dozer, rippers etc. – Power and capacity of earthmoving machines.
SCRAPPERS, GRADERS, SHOVELS AND DITCHERS
Scrappers, elevating graders, motor graders, self powered scrappers and graders, Power shovel, revolving and stripper shovels – drag lines – ditchers – capacity of shovels.
FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES
Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles.
VEHICLE SYSTEMS, FEATURES
Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Design aspects on dumper body, loader bucket and water tank of sprinkler.

TEXT BOOK:

1. Off the road wheeled and combined traction devices – Ash gate Publishing Co.Lt.
2. Satyanarayana. B., Construction planning and equipment, standard publishers and distributors, New Delhi.

REFERENCES:

1. Abrosimov.K. Branberg.A and Katayer.K, Road making machinery, MIR Publishers, Moscow, 1971.
2. Bart H Vanderveen, Tanks and Transport vehicles, Frederic Warne and Co Ltd.,London.
3. Nakra C.P., “Farm machines and equipments” Dhanparai Publishing company Pvt. Ltd.
4. Robert L Peurifoy, “Construction, planning, equipment and methods” Tata McGraw Hill Publishing company Ltd.

CourseDesigners:

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17ATEC06	AUTOMOTIVE SAFETY	Category	L	T	P	C
		EC	3	0	0	3

Preamble

Safety in automotive vehicles is most significant factor and has various sub-systems.

Prerequisite

Nil

Course Objectives

1	To describe on the parameters for designing a vehicle for safety.
2	To detail on the various concepts for designing devices for safety.
3	To detail on the design of components and systems for providing safety to the vehicle and passengers.
4	To describe on collision awareness and avoidance.
5	To detail on the systems for comfort and convenience system standards

Course Outcomes:

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

CO1.	Explain the parameters for safety of a vehicle.	Understand
CO2.	Describe on the concepts of designing safety devices for vehicles.	Understand
CO3.	Recommend applicable components for passenger and vehicle safety.	Apply
CO4.	Recommend methods for avoidance of collision and devices for passenger safety.	Apply
CO5.	Recommend on systems for passenger safety and comfort as per standards.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO2	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO3	S	S	S	M	M	--	--	-	--	--	--	-	S	--	--
CO4	S	S	S	M	M	--	--	-	--	--	--	-	S	--	--
CO5	S	S	S	M	M	--	--	-	--	--	--	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION
Design of the body for safety, energy equation, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone
SAFETY CONCEPTS
Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact
SAFETY EQUIPMENTS
Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety
COLLISION WARNING AND AVOIDANCE
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions
COMFORT AND CONVENIENCE SYSTEM
Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

TEXT BOOK:

1. *Bosch, "Automotive Handbook", 8th Edition, SAE publication, 2011.*
2. *Powloski. J., "Vehicle Body Engineering", Business books limited, London, 1969.*

REFERENCES:

1. Ronald.K.Jurgen, "Automotive Electronics Handbook", Second Edition, McGraw-Hill Inc.,

CourseDesigners:

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17BMEC09	DESIGN OF MEDICAL DEVICES	Category	L	T	P	Credit
		EC-PC	3	0	0	3

PREAMBLE

This course will offer students exposure to the core concepts of the global medical device regulatory framework and provide a foundation for the practical application. It includes all elements of the device product lifecycle from idea to initial market entry, sustaining activities and post-market activities.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the post-marketing requirements associated with medical devices.
2	To understand the necessary steps to take an idea to a prototype.
3	To follow a deterministic engineering design process to create new products.
4	To apply engineering theory to practice.
5	To perform risk assessment and countermeasure development.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO12.	Discuss the necessary steps to take an idea to a prototype.	Understand
CO13.	Utilize fundamental design principles, machine elements, manufacturing and assembly techniques.	Apply
CO14.	Analyze risk management concepts into the quality management system.	Analyze
CO15.	Assess the medical device regulatory framework for any given country based upon device type.	Evaluate
CO16.	Create potential regulatory pathway.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	--	--	--	--	--	--	--	M	--	--	M	S	S	M
CO2	S	M	--	--	--	--	--	--	M	--	--	M	S	S	M
CO3	S	M	M	L	--	M	--	L	M	--	--	S	M	M	S
CO4	S	S	M	M	M	S	--	M	S	--	M	S	M	S	S
CO5	S	S	S	M	M	S	--	M	S	--	M	S	S	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MEDICAL DEVICES AND MEDICAL DEVICE REGULATIONS

Medical Device Classification, Bioethics and Privacy, Biocompatibility and Sterilization Techniques, Design of Clinical Trials, Design Control & Regulatory Requirements.

INTRODUCTION TO SPECIFIC MEDICAL TECHNOLOGIES

Biopotential measurement (EMG, EOG, ECG, EEG), Medical Diagnostics (In-vitro diagnostics), Medical Diagnostics (Imaging), Minimally Invasive Devices, Surgical Tools and Implants.

MEDICAL DEVICES STANDARD AND INTELLECTUAL PROPERTY

Standard-ISO, IES, Intellectual Property - Patents, Copy rights, Trademarks, Trade secrets.

HARDWARE AND SOFTWARE DESIGN

Hardware design, Hardware risk analysis, Design and project merits, Design for six sigma, software design, software coding, software risk analysis, software metrics.

DESIGN TRANSFER AND MANUFACTURING

Transfer to manufacturing, hardware manufacturing, software manufacturing, configuration management, documents and deliverables.

TEXT BOOKS:

1. *Richard Fries,* ***"Reliable Design of Medical Devices"****, CRC Press, 2nd Edition, 2006.*
2. *Paul H. King, Richard C. Fries, Arthur T. Johnson,* ***"Design of Biomedical Devices and Systems"****, Third Edition, ISBN 9781466569133.*

REFERENCES:

1. *John G. Webster (ed),* ***"Medical Instrumentation: Application and Design"****, 2007.*
2. *Peter J. Ogrodnik,* ***"Medical Device Design: Innovation from Concept to Market"****, Academic Press Inc; 1st Edition (2012), ISBN-10: 0123919428*

COURSE DESIGNERS

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17ATEC18	ALTERNATIVE FUELS	Category	L	T	P	C
		EC(PS)	3	0	0	3

Preamble

Conventional fuels used in automotive are sourced from fossil fuels and in the current scenario, fossil fuels are depleting . Alternate fuels for use in internal combustion engines are increasing as a replacement of fossil fuels .

Prerequisite

Nil

Course Objectives

1	To provide the biochemistry of alternate fuels for use in automotive engines.
2	To detail on the different methods of generation of alternate fuels from various bio resources.
3	To describe the composition and properties of bio-diesel for use in automotive engines.
4	To elucidate the different options available for production of new alternate fuels.

Course Outcomes:

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

CO1.	Summarize on the biochemistry of alternate fuels that are used in automotive engine.	Understand
CO2.	Summarize on the various methods of production of alternate fuels for internal combustion engines.	Understand
CO3.	Appraise on the composition and properties of bio-diesel as an alternate fuel.	Apply
CO4.	Appraise on the various options for production of new alternate fuels.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	M	--	-	-	-	--	-	--	S	--	--
CO2	S	M	M	M	M	--	-	--	-	--	-	-	S	--	--
CO3	S	S	S	M	M	--	-	-	-	--	-	--	S	--	--
CO4	S	S	S	M	M	--	-	--	-	--	-	-	S	--	--
CO5	S	S	S	M	M	--	-	-	-	--	-	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION

Chemistry, Biochemistry, and Microbiology of Lignocellulosic Biomass, Biomass as an Energy Source: Traditional and Modern Views, Structural and Industrial Chemistry of Lignocellulosic Biomass, Lignocellulose as a chemical resource, Physical and chemical pretreatment of lignocellulosic biomass, Biological pretreatments, Acid hydrolysis to saccharify pretreated lignocellulosic biomass,

BIOCHEMISTRY

Cellulases: Biochemistry, Molecular Biology, and Biotechnology, Enzymology of cellulose degradation by cellulases, Cellulases in lignocellulosic feedstock processing, Molecular biology and biotechnology of cellulase production, Hemicellulases: New Horizons in Energy Biotechnology, A multiplicity of hemicellulases, Hemicellulases in the processing of lignocellulosic biomass, Lignin-Degrading Enzymes as Aids in Saccharification, Commercial Choices of Lignocellulosic Feedstocks for Bioethanol Production, Biotechnology and Platform Technologies for Lignocellulosic Ethanols

BIOCHEMICAL ENGINEERING

Biochemical Engineering and Bioprocess Management for Fuel Ethanol, Biomass Substrate Provision and Pretreatment, Wheat straw — new approaches to complete saccharification, Switchgrass, Corn stover, Softwoods, Sugarcane bagasse, Other large-scale agricultural and forestry, biomass feedstocks, Fermentation Media and the "Very High Gravity" Concept, Fermentation media for bioethanol production, Highly concentrated media developed for alcohol fermentations,

COMPOSITION OF BIO DIESEL

Vegetable oils and chemically processed biofuels, Biodiesel composition and production processes, Biodiesel economics, Energetics of biodiesel production and effects on greenhouse gas emissions, Issues of ecotoxicity and sustainability with expanding biodiesel production, Fischer-Tropsch Diesel: Chemical Biomass–to–Liquid Fuel Transformations

DEVELOPMENT OF ALTERNATE FUELS

Radical Options for the Development of Biofuels, Biodiesel from Microalgae and Microbes, Biohydrogen, The hydrogen economy and fuel cell technologies, Bioproduction of gases, Production of H_2 by photosynthetic organisms, Emergence of the hydrogen economy, Microbial Fuel Cells: Eliminating the Middlemen of Energy Carriers Biofuels as Products of Integrated Bioprocesses

TEXT BOOK:

1. *David M. Mousdale, Biofuel-Biotechnology, Chemistry, and sustainable Development, 1st Ed., CRC Press Taylor & Francis Group, 2008*
2. *Joseph M Norbeck, Hydrogen fuel for surface transportation, Society of Automotive Engineers, 1996.*

REFERENCES:

1. *Ayhan Demirbas, Green Energy and Technology, Biofuels, Securing the Planet's Future Energy Needs, 1st edition, Springer, 2009.*
2. *James D. Halderman, James Linder. Automotive Fuel and Emission Control system, Prentice Hall, 2005.*

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7ECEC21	ADVANCED ROBOTICS	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE Advanced Robotics will explore in great depth areas relevant to not only industrial robotics but service robots (i.e. robots outside a factory environment particularly mobile robots) and the application of this technology to real world environments e.g. driverless vehicles, unmanned aerial vehicles and tele-robots. Students will also master robot kinematics and dynamics.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To gain knowledge in robotic elements
2	To explore the kinematics of serial and parallel robotics
3	To know the motion of robot in various coordinates and surfaces

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Illustrate the kinematics of parallel robotics	Apply
CO2. Examine about the kinematics of serial robot such as the direct and inverse kinematic problems	Apply
CO3. Discriminate various robotic elements like sensors and actuators	Analyze
CO4. Investigate the motion of robot in various coordinates	Analyze
CO5. Explore the motion of robot in several surfaces like flat surface, uneven terrain	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	-	-	-	M	S	-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	M	-	-	-
CO3	S	S	S	-	-	-	-	M	-	-	-	M	M	M	-
CO4	S	S	S	-	-	-	-	M	-	-	-	M	-	M	-
CO5	S	S	S	-	-	-	-	M	-	-	-	M	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

Elements of robots -- joints, links, actuators, and sensors

Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Kinematics of serial robots

Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator.

Kinematics of parallel robots

Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.

Motion planning and control

Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators.

Modeling and analysis of wheeled mobile robots

Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS.

Reference Books

1. *Ghosal, A., Robotics: Fundamental Concepts and Analysis, Oxford University Press, 2nd reprint, 2008.*
2. *Fu, K., Gonzalez, R. and Lee, C.S. G., Robotics: Control, Sensing, Vision and Intelligence McGraw- Hill, 1987.*

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17MESE09	NEW PRODUCT DEVELOPMENT	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This course introduces students to the methods that companies use to develop and release new products. New product development is a challenging, rewarding activity that requires multifunctional cooperation and inter-disciplinary skills. For technology companies, successful product development is critical to success.

Prerequisite

NIL

Course Objective

1	To understand the concepts involved in new product process
2	To learn how to integrate the customer and end-consumer into this process.
3	To learn and apply the concepts and tools necessary through case examples and assignments.
4	To actually use the new product development process by conceiving your own new product or service and an introductory launch plan.
5	To participate in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.

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

CO1.	Understand the concept of designing a new product and importance of design	Understand
CO2.	Demonstrate the end user needs and define the design parameters of the products	Understand
CO3.	Relate the market demand and prepare for the launch of the product	Understand
CO4.	Experiment with the concept of new product design to clarify the problems occurring in the design stage	Apply
CO5.	Identify the product elements, scope, operating procedure and outline for patenting procedure	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	S	M		M	M						S	L	L
CO2		M	S	L		S	M						M		
CO3	S		S		M		M		L				M	M	
CO4	S	M	S	S		M		L							
CO5	S	M	S	S				L							M

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO NEW PRODUCT DESIGN
Introduction to New Product Design – Importance – Objectives – The New Product Development Process Principles of Success - Factors influencing product design – Characteristics of a good product design
IDENTIFYING CUSTOMER NEEDS AND PRODUCT SPECIFICATIONS
Interpret raw data in terms of customers need, organize needs in hierarchy and establish the relative importance of needs, Establish target specifications, setting final specifications
CONCEPT AND PRODUCT DESIGN AND DEVELOPMENT
Concept and Idea generation -Activities of concept generation, clarifying problem, search both internally and externally, explore the output, Assessing need for industrial design, industrial design process, management, assessing quality of industrial design - Testing and forecasting
NEW PRODUCT LAUNCH AND MARKET ENTRY
Preparing a Launch Plan - Market Testing - Pricing, Packaging - Integrated Marketing - Customer and Channel Marketing - Innovation Marketing
INTELLECTUAL PROPERTY
Elements and outline, patenting procedures, claim procedure, Design for Environment: Impact, regulations from government, ISO system and IPR.

Text Books

1	Otto K, and Wood K, "Product Design", Pearson Education, 2001.
2	Ulrich K. T, Eppinger S.D and Anita Goyal, "Product Design and Development", Tata McGraw Hill, 2009.

Reference Books

1	New Products Management,9th ed., by Merle Crawford and Anthony DiBendetto

Course Designers

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17MESE22	AUTOMOTIVE INFOTRONICS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

To study Instrument Clusters, Telematics Systems, Power train, Electronic Control Units and Cockpit Electronics products for vehicles.

Prerequisite NIL

Course Objective

1	To Learn the various driver assistant system in a Vehicle.
2	To Learn the Global positioning and navigation system.
3	To known the collision warning and detection system.
4	To study about the adaptive control system and comfort systems in automobiles
5	To study about the security and smart card system.

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

CO1.	Known the vehicle motion control and stabilization system.	Understand
CO2.	Gain the knowledge of Safety and comfort system.	Understand
CO3.	Known the various safety systems used in vehicles.	Understand
CO4.	Describe the basics of vehicle collision and its effects.	Understand
CO5.	Apply the importance of Driver assistance, security and warning system.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-	L	-	-
CO2	S	L	L	-	-	-	-	-	-	-	-	-	L	-	-
CO3	S	L	L	-	-	-	-	-	-	-	-	-	L	-	-
CO4	S	L	L	-	-	-	-	-	-	-	-	-	L	-	-
CO5	S	M	M	L	-	-	-	-	-	-	-	L	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS
DRIVER ASSISTANCE SYSTEMS
Driver information, driver perception, driver convenience, driver monitoring, general vehicle control, longitudinal and lateral control, collision avoidance and vehicle monitoring.
TELEMATICS
Global positioning system, geographical information systems, navigation system, architecture, automotive vision system and road recognition.
COLLISION WARNING AND AVOIDANCE
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions.
ADAPTIVE CONTROL SYSTEMS AND COMFORT SYSTEMS
Adaptive cruise control system, adaptive noise control, active suspension system, power steering, collapsible and tilt able steering column and power windows, Adaptive lighting system.
SECURITY SYSTEMS
Antitheft technologies–mechanical, electromechanical and electronic immobilizers, alarm system, stolen vehicle tracking system, remote keyless entry, smart card system and number plate coding.

Text Books	
1	*Ljubo Vlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.*
2	Robert Bosch, "Automotive Hand Book", 5th Edition, SAE, 2000.
3	Ronald K Jurgen, "Navigation and Intelligent Transportation Systems – Progress in Technology", Automotive Electronics Series, SAE, USA, 1998

Reference Books	
1	*William B Riddens, "Understanding Automotive Electronics", 5th edition, Butter worth Heinemann Woburn, 1998.*
2	*Bechhold, "Understanding Automotive Electronics", SAE, 1998.*
3	Allan W M B, "Automotive Computer Controlled Systems", Elsevier Butterworth-Heinemann, 2011.

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17MESE23	MICRO AND NANO MACHINING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

To present the basics of micro and nano machining technology and its applications.

Prerequisite

NIL

Course Objective

1	To learn about the fundamental as well as advanced knowledge of Micro Nano machining Technology.
2	To explain the basic principles and mechanism of Traditional Micro Nano machining and its applications.
3	To illustrate the basic principles and applications of Advanced Micro Nano Machining.
4	To demonstrate the basic principles and applications of different Abrasive based Micro Nano Machining.
5	To illustrate the fundaments of MEMS and its techniques.

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

CO1.	Explain the basic need of Micro Nano Machining in different industries	Understand
CO2.	Summarize the traditional Micro Nano Machining techniques.	Understand
CO3.	Demonstrate and Understand different mechanisms in Advanced Micro Nano Machining.	Apply
CO4.	Utilize the importance of Abrasives in Micro Nano Machining.	Apply
CO5.	Identify the need of MEMS in Micro Nano Machining.	Apply
CO6.	Perfom the Nano machining capabilities in order to diversify and improve manufacturing technology in the region.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-									S		
CO2	S	L	-	-									S		
CO3	S	M	L	-									S		
CO4	S	M	L	-									S		
CO5	S	M	L	-									S		
CO6	S	S	S	S									S		

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO NANO MACHINING
Need-evolution- fundamentals and trends in micro and nano technologies-Consequences of the technology and society-challenges to manufacturing technology-evolution of precision in manufacturing, tooling and current scenario- Micro Nano materials, fabrication tools, requirements and applications.
TRADITIONAL NANO MACHINING
Theory of micromachining – Chip formation – Size effect in micromachining – Micro turning- Micro milling-Micro drilling-Micro machining tool design – Precision Grinding – Partial ductile mode grinding – Ultra precision grinding.
ADVANCED MICRO NANO MACHINING
Introduction-Classification- Mechanical Micromachining (AJM, USM)- Thermal Micromachining (EDM, LBM, EBM)-Electrochemical and Chemical Micromachining-Ion Beam Machining-Photochemical Etching
ABRASIVE BASED MICRO NANO MACHINING
Abrasive Flow Finishing (AFF)-Magnetic Abrasive Finishing (MAF)-Magnetorheological Finishing-Magnetorheological Abrasive Flow Finishing-Elastic Emission Machining (EEM) and Magnetic Float Polishing
MEMS
Introduction to MEMS, Definitions and classifications-History-applications-MEMS Market-Bulk Micromachining- Wet and Dry Etching-Surface Micromachining-Chemical-Vapor Deposition-Lithography-Wafer Bonding.

Text Books:

1	V.K.Jain, Introduction to Micromachining, Narosa publishing House, New Delhi.
2	Tai-Ran Hsu, “MEMS and Microsystems: Design and Manufacture,” McGraw- Hill, 2008.

Reference Books:

1	J. Paulo Davim, Mark J. Jackson (2009) Nano and Micromachining, John Wiley & Sons.
2	V. K. Jain (2012), Micromanufacturing Processes, CRC Press.
3	Mohamed Gad-el-Hak (2010) MEMS Introduction and Fundamentals, CRC Press.

Course Designers

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17ATEC10	ALTERNATIVE ENERGY SOURCES FOR AUTOMOBILES	Category	L	T	P	C
		EC(PS)	3	0	0	3

Preamble

Petroleum based fuels are the energy sources for almost all automotive vehicles. With fossil fuels expecting to get depleted, new and alternate sources of energy for automotive vehicles are on the search since decades. Many known forms of energy are being explored for use in automotive.

Prerequisite

Nil

Course Objectives

1	To brief the various available options as alternate energy sources for automotive vehicles.
	To detail on the use of alcohol based chemicals as an alternate source of energy for automotive vehicles.
3	To describe on the possibilities of using LPG, CNG, Hydrogen and Biogas as a form of alternate source of energy for automotive vehicles.
4	To explain on the methods of using vegetable oils as alternate fuel for automotive engines.
5	To describe on the modes of systems developed for using electrical energy and solar energy as an alternate energy source for automotive vehicles.

Course Outcomes:

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

CO1.	Summarize on the various alternate energy sources for an automotive vehicle	Understand
CO2.	Recommend a suitable alcohol based chemical fuel as an alternate energy source for an automotive engine.	Understand
CO3.	Appraise on the utility of gases as a possible source of energy for automotive engines.	Apply
CO4.	Appraise on the exact method of generating alternate fuel from vegetable oils.	Apply
CO5.	Appraise on the different systems for developing an electric and a solar vehicle.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO2	S	M	M	M	--	--	--	-	--	--	--	-	S	--	--
CO3	S	S	S	M	M	M	--	-	--	--	--	-	S	--	--
CO4	S	S	S	M	M	M	--	-	--	--	--	-	S	--	--
CO5	S	S	S	M	M	M	--	-	--	--	--	-	S	--	--

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION
Estimation of petroleum reserve - Need for alternate fuel - Availability and properties of alternate fuels– general use of alcohols - LPG - Hydrogen - Ammonia, CNG, and LNG - Vegetable oils and Biogas - Merits and demerits of various alternate fuels.
ALCOHOLS
Properties as engine fuel, alcohols and gasoline blends, performance in SI engine. Methanol and gasoline blends Combustion characteristics in engines - emission characteristics.
CNG, LPG, HYDROGEN AND BIOGAS
Availability of CNG, properties, modification required to use in engines - performance and emission characteristics of CNG using LPG in SI & CI engines. Performance and emission for LPG - Hydrogen – Storage and handling, performance and safety aspects.
VEGETABLE OILS
Various vegetable oils for engines - Esterification - Performance in engines - Performance and emission Characteristics
ELECTRIC AND SOLAR POWERED VEHICLES
Layout of an electric vehicle - Advantage and limitations - Specifications - System component. Electronic control system - High energy and power density batteries - Hybrid vehicle - Solar

TEXT BOOK:

1. *K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.*
2. *MaheswarDayal, " Energy today & tomorrow ", I & B Horishr India, 1982*

REFERENCES:

1. *" Alcohols and motor fuels progess in technology ", Series No.19, SAE Publication USA 1980.*
2. *SAE Paper Nos. 840367, 841156, 841333, 841334.*
3. *" The properties and performance of modern alternate fuels " - SAE Paper No.841210.*

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17ECCC11	DATA COMMUNICATION NETWORKS	Category	L	T	P	Credits
		CC	3	0	0	3

PREAMBLE

To introduce the concepts of communication networks, in depth understanding of network architecture of different layers of data communications and its security protocols.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To understand the physical layers of layered models.
2	To be exposed to error detection/correction & medium access controls.
3	To be familiar with Internet Protocols & current scenario
4	To understand the concepts of Transport & Application layers.
5	To be familiar with Network & Internet security.

Course Outcomes

On the successful completion of the course, students will be able to

CO1. Understand the basics and working of layered architecture	Understand
CO2. Differentiate different error control, Link control, access control and different LAN Technologies. Also to evaluate merits and demerits	Apply
CO3. Explain the role of protocol and design it for appropriate routing mechanism.	Analyze
CO4. Analyze the various transport and application layer protocols in real time.	Analyze
CO5. Study the functioning and methods of data and network security.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	M	-	-	L	-	-	-	L	-	-	L	-	-	-
CO2	S	S	L	-	M	-	-	-	-	L	-	-	S	M	-
CO3	S	S	M	-	-	-	-	-	M	L	L	-	-	-	M
CO4	S	S	L	-	-	-	-	L	L	L	L	L	S	M	M
CO5	M	L	L	-	L	-	-	M	M	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

Syllabus

Physical Layer.

Data Communications-Networks & its types-Standards-Networks models –Protocol layering-TCP / IP protocol suite-OSI model.

Digital to Digital conversion-Analog to Digital conversion-Transmission modes-Digital to Analog conversion- Analog to Analog conversion-Multiplexing-Spread spectrum-Guided and Unguided Transmission media-Switching-Circuit switched networks-Packet switching-Structure of Switch.

Data Link Layer.

Link layer addressing.

Error Detection & Correction: Block coding-Cyclic codes-Checksum-Forward error correction. Data link control: DLC services-Data link layer protocols-HDLC-PPP.

Medium Access Control: Random access-Controlled access-Channelization.

Wired LANS: Ethernet protocol-Standard Ethernet-Fast Ethernet & Gigabit Ethernet.

Wireless LANS: IEEE 802.11 project-WiMAX-Cellular Telephony-Satellite networks.

Connecting devices, Virtual LANS.

Network Layer.

Network layer services-Packet switching-Performance-IPv4 Addresses.

Internet Protocol, ICMPv4, Mobile IP.

Unicast Routing: Routing algorithms-Unicast routing protocols.

Multicast routing: Multicasting basis-Intra domain & Inter domain Multicast protocols, IGMP.

Next Generation IP: IPv6 Addressing-IPv6 protocol-ICMPv6 protocol-Transition from IPv4 to IPv6.

Transport & Application Layer
Transport layer protocols-User Datagram Protocol-Transmission Control Protocol-SCTP.
Client server programming-WWW & HTTP-FTP-Electronic mail-TELNET-SSH-DNS-SNMP-Compression- Multimedia Data & in the Internet- Real-Time Interactive protocol-P2P Networks-CHORD-PASTRY-KADEMLIA-BITTORNET.

Network & Internet Security
Quality of Service: Data flow characteristics-Flow control to improve QoS-Integrated services-Differentiated services.
Cryptography: Introduction-Confidentiality-Other aspects of Security.
Internet Security: Network layer security-Transport layer security-Application layer security-Firewalls.

TEXT BOOK:

8. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill, 2013.

REFERENCE BOOKS:

7. 1. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, Fifth Edition, 2011.
8. James F. Kurose, Keith W. Ross, "Computer Networking- A Top -Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
9. Larry L. Peterson, Bruse S. Davie, "Computer Networks: A System Approach",Fifth Edition, Morgan Kaufmann Publishers, 2011.
10. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.

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17AREC03	UNMANNED AIRCRAFT SYSTEMS	Category	L	T	P	Credit
		ELECTIVE	3	0	0	3

Preamble

This course is designed to develop hands on skills in operation of unmanned aerial vehicles which is the latest demand of present situation.

Prerequisite

NIL

Course Objectives

1	To provide information on Unmanned Aerial Vehicles (UAV) and its types.
2	To create interest in developing and operating UAV.
3	To model and add additional features in unmanned vehicles.

Course Outcomes

In the successful completion of the course, students will be able to

CO1.	Define and label parts of unmanned aerial vehicles.	Remember
CO2.	Explain principle and operation of aerial vehicles.	Understand
CO3.	Demonstrate analytical skills to develop a new system.	Apply
CO4.	Categorise the system for highest reliability and performance.	Analyze
CO5.	Recommend modification in the system.	Evaluate
CO6.	Build a new vehicle with additional features.	Create

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1.	L	L	L	L	-	-	-	-	-	-	-	-	M	M	M
CO2.	L	L	L	L	-	-	-	-	-	-	-	-	M	M	M
CO3.	S	M	L	L	L	M	-	-	S	-	-	-	M	M	M
CO4.	S	S	M	M	M	S	-	-	M	M	-	-	S	M	M
CO5.	S	S	S	S	S	S	-	-	S	S	S	S	S	S	S
CO6.	S	S	S	S	S	S	-	S	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS	**9**
History of unmanned aerial vehicles- types- Introduction to Unmanned aircraft systems-Unmanned aerial vehicles – Micro aerial vehicles definitions, history, classification- applications-recent research and development in civil and defense applications – autonomous vehicles -future research in autonomous vehicles – design standards and regulatory aspects introduction to design and selection of systems.	
ASPECTS OF UNMANNED AIRCRAFT SYSTEMS	**9**
Involvement of different aspects in the development of UAV-aerodynamic configurations -Aspects of airframe design- Stealth design, payload types, communication, navigations & guidance systems, control & stability, launch, recovery and support systems, reliability design.	
MODELING AND CONTROL HELICOPTER MODEL	**9**

Modeling and control of small and miniature unmanned helicopters –single rotor helicopter design – coaxial rotor helicopter design - autonomous control of a mini quad-rotor vehicle using LQG controllers – linearization and identification of helicopter model.	
UNMANNED AERIAL VEHICLE DESIGN MODELING & CONTROL	**9**
Development of autonomous quad tilt wing – advanced flight control systems for rotorcraft UAV and MAV – mathematical modeling and non- linear control of VTOL aerial vehicles.	
DEPLOYMENT OF UAS/UAV SYSTEMS	**9**
Only application point of view of various UAS roles played in civil, defense applications -vision based navigation company trails- certification of UAS/UAV/MAV systems.	
TEXT BOOK:	
1. Barnhart, Hottman, Marshall, Shappee, *Introduction to Unmanned Aircraft Systems*, CRC Press, Taylor and Francis Group 2. Kenzo Nonami, Farid Kendoul, Satoshi Suzuki, Wei Wang, Daisuke Nakazawa, Modeling and Control of Unmanned Small Scale Rotorcraft UAVs & MAVs, Springer, New York, 2010 3. Laurence R. Newcome, Unmanned Aviation: A Brief History of Unmanned Aerial Vehicles, American Institute of Aeronautics and Astronautics, New York, 2004	
REFERENCES:	
1. Reg Austin, *Unmanned Aircraft Systems*, Wiley and Sons Ltd, 2010. 2. Elizabeth Bone, Christopher Bolkcom, *Unmanned Aerial Vehicles*, Novinka Books, United Kingdom 2004 3. Rogelio Lozano, *Unmanned Aerial Vehicles Embedded Control*, John Wiley & Sons, 2010 4. Pedro Castillo, Rogelio Lozano, Alejandro E. Dzul, *Modelling and Control of Mini-Flying Machines, Advances in Industrial Control (Aic)*, Springer-Verlag, London,2005	

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17CSCC33	PROBLEM SOLVING USING COMPUTER	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course is designed to introduce basic problem solving and program design skills that are used to create computer programs. It gives engineering students an introduction to programming and developing analytical skills to use in their subsequent course work and professional development. This course focuses on problem solving, algorithm development, top-down design, modular programming, debugging and testing using the programming constructs like flow-control, looping, iteration and recursion. It presents several techniques using computers to solve problems, including the use of program design strategies and tools, common algorithms used in computer program and elementary programming techniques.

PRERQUISITE

Nil

COURSE OBJECTIVES

1.	To understand the basic concepts of problem solving methodology.
2.	To study and apply algorithm design.
3.	To study and apply programming and developing skills.
4.	To understood, analyze and evaluate the problem.
5.	To apply, analyze, evaluate and solve the problem by using programming concepts.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Comprehend the role of computing and use of programming concepts in developing engineering solutions.	Understand
CO2. Develop algorithms to solve fundamental mathematical problems, merging, sorting and searching.	Apply
CO3. Develop algorithms for text processing and pattern searching	Analyze
CO4. Analyze a problem, identify the data in the problem, divide a problem into parts, solve individual parts using proper control structures and compose into an overall solution	Evaluate
CO5. Design algorithmic solutions to problems drawn from engineering contexts and implement using any structured programming language	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	M	-	-	-	-	-	-	-	-	M	M	-
CO2	M	M	M	M	-	-	-	-	-	-	-	-	M	M	-
CO3	M	M	S	M	-	-	-	-	-	-	-	-	M	M	-
CO4	S	M	M	M	-	-	-	-	-	-	-	-	M	-	-
CO5	S	M	M	M	-	-	-	-	-	-	-	-	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to problem solving with computers - Computing Systems:

Hardware and Software – Engineering Problem Solving Methodology: problem specification and analysis, algorithm design, flowchart, implementation, program testing and verification.

Algorithm Design: Fundamental algorithms:

Swapping of two variables – counting – summation of set of numbers – factorial – Fibonacci sequence – base conversion Factoring Techniques: smallest divisor of an integer – greatest common divisor – generating prime number – generating prime factor

Merging, Sorting and Searching Techniques:

Two way merge – sorting by selection sort – sorting by exchange – sorting by insertion – linear search – binary search Array techniques: Array order reversal – Statistical measurement - array counting - array Partitioning Text Processing and Pattern Searching: Key word search – text line editing –linear pattern search.

Programming Concepts:

Basics of programming -Constant, variable, keywords, data types - Operators, operator precedence, expressions - Control Structures: Selection structure- Repetition Structure.

Modular Programming and Functions:

User defined functions- Recursive functions Array Handling: 1-D, 2-D: declaration – initialization, Using arrays as function arguments- Strings Pointers: Basics of Pointers - Arrays and Pointers - Pointers and Functions - Structures and Union - File Handling.

TEXT BOOK:

1. R. G. Dromey, "How to solve it by Computer", Pearson Education India,2014

REFERENCES:

1. *Maureen Sprankle, Jim Hubbard, "Problem Solving & Programming Concepts",*
2. *Prentice Hall, 2012*
3. *Jeri R. Hanly - Elliot B. Koffman, "Problem Solving and Program Design in C", 7th Edition, Pearson, 2013*
4. *Delores M. Etter, "Engineering Problem Solving with C", Pearson, 4th Edition, 2013.*
5. *Donald E. Knuth, "Art of Computer Programming", Pearson Education, 2012.*
6. *Yashavant Kanetkar, "Let us C", 8th Edition, BPB Publications, 2007.*

COURSE DESIGNERS

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17CSCC08	COMPUTER NETWORKS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The purpose of this course is to understand the concepts of data communication and computer networks. Identify the components required to build different types of networks. Choose the required functionality at each layer for given application. Identify the solution for each functionality for each layer. Trace the flow of information from one node to another node in the network.

PREREQUISITE

NIL

COURSE OBJECTIVES

1.	To provide basic knowledge in networking concepts.
2.	To introduce and demonstrate various bridges, switches and Ethernets.
3.	To introduce different methodologies in routing.
4.	To learn about transmission protocols and QOS.
5.	To provide knowledge about different application protocols.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO1.Learn the fundamentals of networks and different types of OSI Layers.	Understand
CO2.Learn the different Ethernet, wireless networks, switching and bridging concepts	Understand
CO3.Design solutions for complex routing methods and different multicast routing techniques.	Evaluate
CO4.Learn the concepts of different protocols for transmission purpose and study the quality of service for TCP protocol.	Understand
CO5.Learn different types of application protocols and its architecture.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	-	-		-	-	-		-	M	M
-CO2	S	M	M	-	-	-	-	-	-	-	-	-	-	M	M
CO3	S	M	S	M	-	-	-	-	-	-	-	-	-	M	M
CO4	S	M	M	-	-	-	-	-	-	-	-	-	-	M	M
CO5	S	M	M	-	-	-	-	-	-	-	-	-	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF OSI LAYERS

Building a network – Requirements - Layering and protocols - Internet Architecture – Network software – Performance ; Link layer Services - Framing - Error Detection - Flow control.

MEDIA ACCESS & INTERNETWORKING

Media access control - Ethernet (802.3) - Wireless LANs – 802.11 – Bluetooth - Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP).

ROUTING

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6) - Multicast – addresses – multicast routing (DVMRP, PIM).

TRANSPORT LAYER

Overview of Transport layer - UDP - Reliable byte stream (TCP) - Connection management - Flow control - Retransmission – TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements.

APPLICATION LAYER

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP.

TEXT BOOKS:

1. *Behrouz A. Foruzan, "Data communication and Networking", Seventh Edition, Tata McGraw-Hill, 2017.*
2. *Andrew S. Tannenbaum, David J. Wetherall "Computer Networks", Pearson Education, Eighth Edition, 2016.*

REFERENCES:

1. *William Stallings, "Data and Computer Communication", Eighth Edition, Pearson Education.*
2. *Knuth,D.E., "Computer Communication and Networks", Sixth Edition , McGrath-Hill, 2016.*

COURSE DESIGNERS

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17EEPI01	PROJECT WORK AND VIVA VOCE	Category	L	T	P	Credit
		PI	0	0	18	9

PREAMBLE

The project provides learners with the opportunity to explore a problem or issue of particular personal or professional interest and to address that problem or issue through focused study and applied research under the direction of a faculty member. The project demonstrates the learner's ability to synthesize and apply the knowledge and skills acquired in his/her academic program to real-world issues and problems. This final project affirms learners' ability to think critically and creatively, to solve practical problems, to make reasoned and ethical decisions, and to communicate effectively.

PREREQUISITE –Nil

COURSE OBJECTIVES

1	To provide learners with the opportunity to apply the knowledge and skills acquired in their courses to a specific problem or issue.
2	To allow learners to extend their academic experience into areas of personal interest, working with new ideas, issues, organizations, and individuals.
3	To encourage learners to think critically and creatively about academic, professional, or social issues and to further develop their analytical and ethical leadership skills necessary to address and help solve these issues.
4	To provide learners with the opportunity to refine research skills and demonstrate their proficiency in written & oral communication skills.
5	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2. Extend their academic experience into areas of personal interest, working with new ideas, issues,organizations, and individuals.	Analyze
CO3. Think critically and creatively about academic, professional, or social issues and to furtherdevelop their analytical and ethical leadership skills necessary to address and help solve theseissues.	Create
CO4. Refine research skills and demonstrate their proficiency in written & oral communication skills.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO'S	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	S	L	L	M	M	-	-	-	M	M	-	M	M	M	-
CO2	M	M	M	M	L	-	-	-	M	L	-	M	M	M	M
CO3	S	S	M	M	-	-	-	L	-	L	S	M	S	S	-
CO4	S	M	M	M	-	-	-	L	-	L	M	M	S	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. *The project is a major component of our engineering curriculum: it is the culmination of the program of study enabling the learners to showcase the knowledge and the skills they have acquired during the previous four years, design a product/service of significance, and solve an open-ended problem in engineering.*
2. *Each student must register to the project course related to his or her program*
3. *Project course consists of one semester and would be allowed to register only during the final year of study.*
4. *Project may be initiated during the pre-final semester but will be assessed and credits transferred only during the last semester of study, upon completion of all other degree requirements. Generally the undergraduate project is a team based one.*
5. *Each team in the major course will consist of maximum of 5 learners.*
6. *Each project will be assigned a faculty, who will act as the supervisor.*
7. *The project shall be driven by realistic constraints like that related to economic, environmental, social, political, ethical, health & safety, manufacturability and sustainability.*
8. *Each group must document and implement a management structure. Group leadership roles must be clearly identified including who has responsibility for monitoring project deliverables and group coordination.*
9. *A group project may be interdisciplinary, with learners enrolled in different engineering degrees, or in Engineering plus other faculties such as Management, Medical and Health Sciences, Science and Humanities.*
10. *Each student team is expected to maintain a log book that would normally be used to serve as a record of the way in which the project progressed during the course of the session.*
11. *Salient points discussed at meetings with the supervisor (i.e., suggestions for further meetings, changes to experimental procedures) should be recorded by the student in order to provide a basis for subsequent work.*
12. *The logbook may be formally assessed;*
13. *The contribution of each individual team member will be clearly identified and the weightage of this component will be explicitly considered while assessing the work done.*
14. *A project report is to be submitted on the topic which will be evaluated during the final review.*
15. *Assessment components will be as spelt out in the regulations.*
16. *The department will announce a marking scheme for awarding marks for the different sections of the report.*
17. *The project report must possess substantial technical depth and require the learners to exercise analytical, evaluation and design skills at the appropriate level.*

COURSE DESIGNERS

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1	Dr.R.Devarajan	Professor	EEE	deverajan@vmkvec.edu.in
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17EEPI02	MINI PROJECT	Category	L	T	P	Credit
		PI	0	0	6	3

PREAMBLETo obtain hands-on experience in converting a small novel idea / technique into a working model / prototype involving multi-disciplinary skills and / or knowledge and working in at team.

PREREQUISITE –Nil

COURSE OBJECTIVES

1	To conceptualize a novel idea / technique into a product
2	Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
3	To understand the management techniques of implementing a project
4	To take on the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Apply the knowledge and skills acquired in their courses to a specific problem or issue.	Apply
CO2.Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component	Apply
CO3. Take the challenges of teamwork, prepare a presentation in a professional manner, and document all aspects of design work	Analyze
CO4. Explain design thinking practices and their applications	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	L	-	-	-	M	M	-	M	M	M	M
CO2	S	L	L	M	M	-	-	-	M	M	-	M	M	M	-
CO3	M	M	M	M	L	-	-	-	M	L	-	M	M	M	M
CO4	S	S	M	M	-	-	-	L	-	L	S	M	S	M	-

S- Strong; M-Medium; L-Low

Norms

- *Each student must register to the project course related to his or her program*
- *Mini Project course consists of one semester and would be allowed to register only during the final year of study.*
- *Minor design project identification, the objective and methodology and expected outcome of the proposed work.*
- *Presentation of the proposed work design, implementation and partial result*
- *Presentation of complete project work with results and discussion Demonstration of project work*
- *Minor Project Report*

COURSE DESIGNERS

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17CSPI07	LEARNING IT ESSENTIALS BY DOING	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

The proposed elective course exposes the non-CS/IT students to IT Essentials. The core modules of this Elective includes programming , Database and web Technology amongst other related topics. This course refers to the basic tools and technologies for the right type of website development and enable student to create simple web applications

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To learn about the essentials of Information Technology
2	To get an idea about the scripting languages.
3	To get an idea about the internet protocols

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1 Understand the networking concept internet protocols, network routing	Understand
CO2. Understand the fundamentals of web applications and its modeling	Understand
CO3. Understand and learn the scripting languages with design of web applications	Understand
CO4. Analyze the process of mobile communication and network technologies	Analyze
CO5. Build simple interactive applications, database applications and multimedia applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	-	-	-	-	-	-	-	M	**S**	M	M
CO2	S	M	M	M	-	-	-	-	-	-	-	M	**S**	-	M
CO3	S	M	M	M	-	-	-	-	-	-	-	M	**S**	M	M
CO4	M	M	M	M	M	-	-	-	-	-	-	M	**S**	M	-
CO5	M	M	M	M	S	-	-	-	-	-	-	M	**-**	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

Fundamentals of Computer architecture
introduction-organization of a small computer -Central Processing Unit - Execution cycle – Instruction categories – measure of CPU performance Memory – Input/output devices - BUS-addressing modes.
System Software – Assemblers – Loaders and linkers – Compilers and interpreters

Operating system
Introduction – memory management schemes Process management Scheduling – threads.
Problem solving with algorithms- Programming styles – Coding Standards and Best practices - Introduction to C -Programming Testing and Debugging. Code reviews -System Development Methodologies – Software development Models -User interface Design – introduction – The process – Elements of UI design & reports.

RDBMS
Data processing – the database technology – data models-ER modeling concept –notations – Extended ER features -Logical database design - normalization -SQL – DDL statements – DML statements – DCL statements
Writing Simple queries – SQL Tuning techniques – Embedded SQL - OLTP

Objected oriented concepts
Object oriented programming -UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism-Object Oriented Design methodology - Common Base class -Alice Tool – Application of OOC using Alice tool.

Client server computing
Internetworking – Computer Networks – Working with TCP/IP – IP address – Sub netting – DNS – VPN – proxy servers World Wide Web – Components of web application - browsers and Web Servers
URL – HTML – HTTP protocol – Web Applications - Application servers – Web Security.

REFERENCES

1. Andrew S. Tanenbaum, Structured Computer Organization, PHI, 3rd ed., 1991
2. Silberschatz and Galvin, Operating System Concepts, 4th ed., Addision-Wesley, 1995
3. Dromey R.G., How to solve it by Computers, PHI, 1994
4. Kernighan, Ritchie, ANSI C language PHI,1992
5. Wilbert O. Galitz, Essential Guide to User Interface Design, John Wiley, 1997
6. Alex Berson, Client server Architecture, Mc Grew Hill International, 1994
7. Rojer Pressman, Software Engineering-A Practitioners approach, McGraw Hill, 5th ed., 2001
8. Alfred V Aho, John E Hopcroft, Jeffrey D Ullman, Design and Analysis of Computer Algorithms, Addison Wesley Publishing Co., 1998
9. Henry F Korth, Abraham Silberschatz, Database System Concept, 2nd ed. McGraw-Hill International editions, 1991
10. Brad J Cox, Andrew J.Novobilski, Object – Oriented Programming – An evolutionary approach, Addison – Wesley, 1991

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2.	Mr. K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in

17CSPI04	BUSINESS INTELLIGENCE AND ITS APPLICATIONS	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

Business Intelligence (BI) refers to the tools, technologies, applications and practices used to collect, integrate, analyze, and present an organization's raw data in order to create insightful and actionable business information in Data mining.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To Introduce students to various business intelligence concepts
2	To learn the concepts of data integration used to develop intelligent systems for decision support
3	To introduce visualization tool for prepare the enterprise reporting
4	To learn analytical components and technologies used to create dashboards and scorecards, data/text/Web mining methods
4	To gain new insights into organizational operations in implementation of systems for Business Intelligence (BI)

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Learn about the concepts of OLTP and OLAP for BI infrastructure development	Understand
CO2. Gained an understanding of how business professionals can use analytics techniques to formulate and solve relevant problems and how they use analytics to support decision making	Analyze
CO3. Apply Clustering, Association and Classification techniques for Data Integration	Apply
CO4. Assess BI tools to solve problems, issues, and trends using predictive analysis	Apply
CO5. Develop systems to measure, monitor and predict the enterprise variables and performance indicators for business decision-making process	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M
CO2	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M
CO3	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M
CO4	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M
CO5	S	M	L	-	M	-	-	-	-	-	-	M	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BUSINESS INTELLLIGENCE

Introduction to OLTP AND OLAP – BI Definition and BI Concepts – Business Applications of BI - BI Framework- Role of Data Warehousing in BI –BI Infrastructure Components- BI Process – Developing Data Warehouse – Management Framework – Business driven approach –BI Technology –– BI Roles & Responsibilities.

BASICS OF DATA INTEGRATION

Concepts of Data Integration need and advantages of using Data Integration – Introduction to common data integration approaches – Introduction to ETL using SSIS – Introduction to Data Quality – Data Profiling Concepts and Applications.

INTRODUCTION TO MULTIDIMENSIONAL DATA MODELING

Introduction to Data and Dimensional Modeling – Multi Dimensional Data Model – ER modeling Vs Multi Dimensional Model – Concepts of Dimensions - facts - cubes- attributes- hierarchies- star and snowflake schema – Introduction to Business Metrics and KPIs – Creating Cubes using SSAS.

BASICS OF ENTERPRISE REPORTING

Introduction to Enterprise Reporting - Concepts of dashboards - balanced scorecards – Introduction to SSRS Architecture– Enterprise Reporting using SSRS reporting service

BI ROAD AHEAD

BI and Mobility – BI and cloud computing – BI for ERP systems - Benefits of BI in ERP-NorthWind_Traders Data-Data Analyses through Excel-Kettle Tool – Conversion of data using Kettle Tool.

TEXT BOOKS

1.RN Prasad, Seema Acharya, "Fundamentals Of Business Analytics" Wiley India,2011

REFERENCES

1.Soumendra Mohanty, "Data Warehousing Design, Development and Best Practices", Tata McGraw-Hill, New Delhi, 2007.

2.David Loshin, "Business Intelligence", Morgan Kaufmann Publishsers, San Francisco, Fifth edition, 2007.

3.Larissa Terpeluk Moss and Shaku Atre, "Business Intelligence Roadmap", Pearson Education, 2007

COURSE DESIGNERS

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2.	Mrs. S. Leelavathy	Assistant Professor(G-II)	CSE	leelavathy@avit.edu.in

17EEPI03	VIRTUAL INSTRUMENTATION	**Category**	**L**	**T**	**P**	Credit
		PI	**3**	**0**	**0**	**3**

PREAMBLE

A virtual instrument consists of an industry-standard computer or workstation equipped with powerful application software, cost-effective hardware such as plug-in boards, and driver software, which together perform the functions of traditional instruments.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	Review background information required for studying virtual instrumentation.
2	Study the basic building blocks of DAQ in virtual instrumentation.
3	Study the various techniques of interfacing of external instruments of PC.
4	Study the various graphical programming environments in virtual instrumentation
5	Study a few applications in virtual instrumentation

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Review the study of signal time domain and AC/DC converters.	Remember
CO2: The concepts of operation of virtual instrumentation and classification.	Understand
CO3:Classify and design of interfacing of external instruments	Evaluator
CO4: Apply the concepts of graphical programming.	Apply
CO5: Analyze the tools and simple applications in systems for Fourier transform Power spectrum correlation windowing and filtering tools.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	L	S	M	L	M	S	-	-	-	L	M	-
CO2	-	S	M	-	S	M	L	M	S	-	-	-	L	M	-
CO3	S	--	-	-	-	M	L	M	S	L	L	-	M	M	-
CO4	S	M	S	L	S	M	L	M	S	-	-	-	M	S	-
CO5	M	M	M	L	S		L		S	-	-	L	M	S	-

S- Strong; M-Medium; L-Low

REVIEW OF DIGITAL INSTRUMENTATION

Representation of analog signals in the digital domain - Review of quantization in amplitude and time axes, sample and hold, sampling theorem, ADC and DAC.

FUNDAMENTALS OF VIRTUAL INSTRUMENTATION

Concept of virtual instrumentation - PC based data acquisition - Typical on board DAQ card - Resolution and sampling frequency - Multiplexing of analog inputs - Single-ended and differential inputs - Different strategies for sampling of multi-channel analog inputs. Concept of universal DAQ card - Use of timer-counter and analog outputs on the universal DAQ card.

CLUSTER OF INSTRUMENTS IN VI SYSTEM

Interfacing of external instruments to a PC - RS232, RS 422, RS 485and USB standards - IEEE 488 standard - ISO-OSI model for serial bus - Introduction to bus protocols of MOD bus and CAN bus.

GRAPHICAL PROGRAMMING ENVIRONMENT IN VI

Concepts of graphical programming - Lab-view software - Concept of VIs and sub VI - Display types - Digital - Analog - Chart Oscilloscopic types - Loops - Case and sequence structures - Types of data - Arrays - Formulae nodes -Local and global variables String and file I/O.

ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI

Fourier transform - Power spectrum - Correlation - Windowing and filtering tools - Simple temperature indicator - ON/OFF controller -

P-I-D controller - CRO emulation - Simulation of a simple second order system - Generation of HTML page.

TOTAL HOURS: 45

TEXT BOOKS

1. S. Gupta and J.P Gupta, 'PC Interfacing for Data Acquisition and Process Control', Instrument society of America, 1994.
2. Peter W. Gofton, 'Understanding Serial Communications', Sybex International. 3. Robert H. Bishop, 'Learning with Lab-view', Prentice Hall, 2003.

REFERENCE BOOKS

1. Kevin James, 'PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control', Newness, 2000.
2. Gary W. Johnson, Richard Jennings, 'Lab-view Graphical Programming', McGraw Hill Professional Publishing, 2001.

COURSE DESIGNERS

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1	Mr.A.Balamurugan	Associate Professor	EEE/VMKVEC	balamurugan@vmkvec.edu.in
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17EEPI04	INTRODUCTION TO INDUSTRIAL INSTRUMENTATION	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

This course is designed to cover all aspects of industrial instrumentation, such as sensing a wide range of variables, the transmission and recording of the sensed signal, controllers for signal evaluation, and the control of the manufacturing process for a quality and uniform product. Instrumentation and process control involve a wide range of technologies and sciences, and they are used in an unprecedented number of applications. Examples range from the control of heating, cooling, and hot water systems in homes and offices to chemical and automotive instrumentation and process control. Today's technological evolution has made it possible to measure parameters deemed impossible only a few years ago. Improvements in accuracy, tighter control, and waste reduction have also been achieved

PREREQUISITE

17EECC04 Measurements and Instrumentation

COURSE OBJECTIVES

1	To provide fundamental background in theory of Industrial Instrumentation system
2	To teach the knowledge for the measurement of length, angle and area. and familiarize with motion and vibration measurement, explain different methods for pressure and flow measurement.
3	To give a detailed knowledge on transducer characteristics and uncertainties in measurement, application of different sensors / transducers their signal conditioning and final control elements for instrumentation and control systems
4	To elaborate different types of Level & viscosity measurement
5	To give an overview of the features associated with temperature measurement and pyrometers

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1	Explain the different types of load cell and different types of torque Measurement. .	Understand
CO2	Describe the principle, operation and different types of accelerometer	Understand
CO3	Evaluate the measurement of Flow and Level for a respective application	Analyze
CO4	Explain the principle and operating characteristics of Viscosity measuring techniques	Understand
CO5	Apply suitable technique for measurement of high temperature and Pressure for a required application	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L			L	L	M	S	M		L	L	M	S
CO2	M	L		L						L				L	L
CO3	S	S	S			L	M	M	M		S	L	S	S	
CO4	M	M		M		M		L	M	L	M	L	L	S	
CO5	S	S	M	M		S	M	S	S	S	S	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

MEASUREMENT OF FORCE, TORQUE

Different types of load cells - Hydraulic, Pneumatic, strain gauge- Magneto-elastic and Piezoelectric load cells - Different methods of torque measurement: - Strain gauge-Relative angular twist

MEASUREMENT OF ACCELERATION, VIBRATION

Accelerometers LVDT, Piezoelectric, Strain gauge and Variable reluctance type accelerometers - Mechanical type vibration instruments - Seismic instruments as accelerometer - Vibration sensor - Calibration of vibration pickups

FLOW MEASUREMENTS

Orifice plate different types of orifice plates , Difference between area flow and mass flow meters, Venturi tube — Flow nozzle - Principle and construction and details of Electromagnetic flow meter — Ultrasonic flow meters

LEVEL & VISCOSITY MEASUREMENT

Float gauges - Electrical types: Conductivity sensors, Boiler drum level measurement - Differential pressure method. Viscosity — Saybolt viscometer-Rota meter type viscometer

HIGH TEMPERATURE MEASUREMENTS & PRESSURE MEASUREMENT

Special techniques for measuring high temperature using thermocouple –Radiation fundamentals - Radiation methods of temperature measurement - Total radiation pyrometers -Optical pyrometers. Units of pressure - Manometers, different types, Elastic type pressure gauges Capacitive type pressure gauge.

Case Study on application of above discussed measurement in Boiler, Furnace process.

TEXT BOOK

1. Patranabis, D. Principles of Industrial Instrumentation, 3rd Edition, Tata McGraw Hill, New Delhi, 2010.
2. Doebelin, E.O. and Manik, D.N., Measurement Systems Application and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES

1. Liptak, B.C., Instrumentation Engineers Handbook (Measurement), CRC Press, 2005.
2. Singh,S.K., Industrial Instrumentation and Control, 3rd edition, McGrawHill Education., New Delhi, 2015.
3. Jain, R.K., Mechanical and Industrial Measurements, 12th edition, Khanna Publishers, Delhi, 2011.
4. A. K. Sawhney, PuneetSawhney Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai & Sons, New Delhi, 1997.
5. Lessons in Industrial Instrumentation 2/3, Volume 2 of Lessons in Industrial Instrumentation Series, Tony R. Kuphaldt, Samurai Media Limited, 2017, ISBN : 9888407090, 9789888407095

COURSE DESIGNERS

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2	S. JENSIE ANITA	Assistant Professor	EEE / AVIT	jensiepresely@avit.ac.in

17APEE01	PERSONALITY SKILLS DEVELOPMENT - I	Category	L	T	P	Credit
		EE	2 WEEKS TRAINING	0	0	1

PREAMBLE

To enhance holistic development of students and improve their employability skills

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To improve aptitude, problem solving skills and reasoning ability
2	To collectively solve problems in teams & group
3	To know the concept of Quantitative analysis
4	To have a good knowledge in reasoning
5	*To identify and solving the Mathematical Puzzles*

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Identify, formulate and solve aptitude problems	Apply
CO2. Apply the knowledge of Mathematics, Science and Engineering in mathematical problems	Apply
CO3. Use the Techniques & skills.	Apply
CO4. Engage in Life-Long Learning.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	--	--	--	--	--	--	--	--	--	S	--	--	--
CO2	S	S	--	--	--	--	--	--	--	--	--	S	--	--	--
CO3	S	S	--	--	--	--	--	--	--	--	--	S	--	--	--
CO4	S	S	--	--	--	--	--	-	--	--	--	S	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

NUMBERS-I

Types and Properties of Numbers, LCM, GCD, Surds and indices

ARITHMETIC – I

Percentages, Profit & Loss, Area and volume

QUANTITATIVE ANALYSIS-I.

Time and works ,Pipes and cistern, Calendar and Clocks

REASONING-I
Mathematical operations, Coding and decoding , Blood relationship

PUZZLES-I
Classification type, Seating arrangements and Comparison types

TEXTBOOKS:
Agarwal.R.S – Quantitative Aptitude for Competitive Examinations, S.Chand Limited 2011

REFERENCES:

1. *Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Tata McGraw Hill, 3rd Edition, 2011*
2. Edgar Thrope, Test Of Reasoning for Competitive Examinations, Tata McGraw Hill, 4th Edition, 2012

COURSE DESIGNERS

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1	Dr. M.Vijayarakavan	Asso.Prof	VMKVEC	vijayarakavan@vmkvec.edu.in
2	Dr.A.K.Thamizhsudar	Asso.Prof. grade II	AVIT	thamizhsudar@avit.ac.in

17APEE02	**PERSONALITY SKILLS DEVELOPMENT - II**	Category	L	T	P	Credit
		EE	2 WEEKS TRAINING	0	0	1

PREAMBLE: SM & S

Personality Skill Development provides a professional approach and makes the students ready for the industry as well as to make them to understand the entrepreneurial approach through various actions. It also breaks down the barriers between the institute and industry by anticipating the technology update.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To learn and practice the Soft skills.
2. To assess the importance of social skills.
3. To practice SWOT analysis for individual and group.
4. To build and enhance the self confidence
5. To apply and observe various personality skills for personality development.

COURSE OUTCOMES:

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

CO1: Understand the importance of Personality related to the working environment.	Understand
CO2: Inculcate relevant interpersonal skills for survival.	Apply
CO3: Analyse various skills of SWOT analysis.	Analysing
CO4: Applying assortment of soft skills for self assessment for both organisationally and socially.	Evaluate
CO5: Build self esteem and relevant personality skills according to goal.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				L		L			L	M	L	L		M	M
CO2		M	M	L			L	M	M			L			M
CO3						M		M	M	L	L	M	M	S	M
CO4		M						L	M	L	L	M		S	M
CO5				L		M	S	M		S	M	S		M	M

S- Strong; M-Medium; L-Low

SYLLABUS:

- Importance of Personality and Skill Development.
- Interpersonal Vs Intrapersonal skill.
- Communication and barriers in Communication.
- SWOT analysis for identifying individual, group and organisation.
- Skills required to Win and influence people
- Seven essential habits of Effective people followed.
- Goal setting – Individual skill to act in a group dynamics.
- Team Building
- Group Discussion
- Role Play
- Time management
- Corporate Etiquettes.
- Personality Grooming
- Body Language
- Career Guidance.
- Resume preparation
- Interview Skill
- Self Assessment

TEXT BOOK:

1. Sharma. P.C., Communication Skills and Personality Development, Nirali Prakashan Pub. Pune

REFERENCE BOOK:

1. Narula S. S, Personality Development and Communication Skills, Taxmann Publications Pvt Ltd

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	mail id
1.	A. Mani	Associate Professor	Management Studies	mani@vmkvec.edu.in
2	Dr.P.Saradha	Associate Professor	English	saradhap@vmkvec.edu.in
3	Dr. V. Sheelamary	Associate Professor	Management Studiec	sheelamary@avit.ac.in

17EEEE01	MATLAB TRAINING	Category	L	T	P	Credit
		EE	0	0	4	2

PREAMBLE

This course introduces the fundamentals of Matlab and to solve the various types of power electronic circuits.

PREREQUISITE:17EECC06 Power Electronics.

COURSE OBJECTIVES

1	To understand the basic of Matlab.
2	To study and familiarize the various types tools boxes of Matlab.
3	To design power electronic circuits using simulation method.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Describe the basic concepts of Matab.	Understand
CO2: Realize the various types of tool boxes in Matlab.	Analyze
CO3: Design the gating signals for various types of power electronic circuits.	Create
CO4: Simulate the various types of power electronic circuits.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	S	-	-	-	-	-	-	-	S	-	-
CO2	S	M	-	-	S	-	-	L	-	-	-	-	S	M	-
CO3	S	M	S	M	S	L	M	L	M	L	M	L	S	M	L
CO4	S	M	S	M	S	L	M	L	M	L	M	L	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Matlab, Simpower tool box, Generation of gating signals, simulation of uncontrolled and controlled rectifiers, Simulation of single and three phase inverters, Simulation of step up and step down cyclo converters.

Applying Matlab on the content of published International Journals as a practice.

Reference Books:

Reference Manual

COURSE DESIGNERS

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1	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
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3	Mr. S. Prakash	Assistant Professor (Gr-II)	EEE/AVIT	sprakash@avit.ac.in

17EEEE02	EMBEDDED SYSTEMS AND ROBOTICS TRAINING	Category				Credit
		EEC				2

PREAMBLE

To understand the basic concepts and familiarize the principle ,implementation of embedded systems and robotics technology tointerfacing into the real world applications.

COURSE OBJECTIVES

	To understand the basic concepts of embedded systems and robotics.
	To implement the concepts to real world applications.
	To minimize the human error through automation.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Understand the basic concepts of embedded and robotics system.	Understand
CO2:Familiarize the importance of the automation system.	Understand
CO3: Implement the concepts to real world applications.	Apply
CO4:Analyze the performance of any automated embedded and robotics based systems	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	[illegible]	-	-	-	-	-	-	-	-	M	-	M
CO2	S	M	-	-	-	-	-	-	-	-	-	-	-	M	-
CO3	S	S	M	[illegible]	M	-	-	-	-	-	-	-	M	S	-
CO4	S	S	M	[illegible]	M	-	-	-	-	-	-	-	M	S	M

S- Strong; M-Medium; L-Low

Syllabus

- Introduction to Embedded Systems and Robotics
- Working with ATmega328PU using embedded c
- Introduction to ARDUINO IDE and Installing Arduino and Drivers.
- Overview of the Development Board.
- Specific Microcontroller Features and Memory Organization of (ATMega 328 PU)
- Interfacing with LED, LCD, Switch, Keypad, Buttons and Seven Segment display Interfacing
- Working with system peripheral like ADC, Timer, PWM and Interrupts.
- Working with Communication protocols like I2C, SPI and UART
- Interfacing with External peripherals like IR, ULTRASONIC, LDR, TEMPERATURE SENSOR, GPS, GSM, zigbee, RFID, Gas Sensor
- Robot controlled by mobile phones and DTMF technology
- Gesture Based Robot controlled by hand gestures using accelerometer sensor
- Swarm Robots that communicate using radio frequencies to work together
- Working in different Robots like Line Follower Robot, Obstacle Follower, Photo tropic Robot, Obstacle Avoide, Pit robot , Robot shuttler , Photo Detector, and White Tracker

REFERENCES

1. User Manual.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.G.Ramakrishnaprabu	Associate Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in
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17EEEE03	ELECTRICAL MACHINE FAULT DETECTION AND DIAGNOSIS	Category	L	T	P	Credit
		EEC	0	0	4	2

PREAMBLE

To understand the basic concepts and familiarize the principle, identified the various faults ofelectrical machines with trouble shooting methods.

COURSE OBJECTIVES

1	To understand the basic concepts of electrical machines.
2	To identify the various faults of electrical machines.
3	To develop the suitable diagnosis method for repair the electrical machines.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Understand the basic concepts of electrical machines and faults .	Understand
CO2:Familiarize the trouble shooting methods.	Understand
CO3: Implement the suitable diagnosis method to solve the issues.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	M	-	-	-	-	-	-	-	-	M	-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	-	L	M	M
CO3	S	S	M	M	M	-	-	-	-	-	-	-	M	S	M

S- Strong; M-Medium; L-Low

Syllabus

Introduction about construction and principle operation of AC and DC machines, Faults in electrical machines, overview of on line and off line fault monitoring system, Importance of diagnosis systems, case study AC machine diagnosis system, DC machine diagnosis system with case studies.

REFERENCES

1. User Manual.

COURSE DESIGNERS

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1	Mr.G.Ramakrishnaprabu	Associate Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in
2	Mr.S.Prakash	Assistant Professor	EEE/AVIT	sprakash@avit.ac.in

17EEEEE04	**Power Plant control and Instrumentation**	**Category**	**L**	**T**	**P**	**Credit**
		EE	**3**	**0**	**0**	**3**

PREAMBL

The power plant control and instrumentation in modern fossil fuel power plants, with an emphasis on selecting the most appropriate systems subject to constraints engineer. It provides all the plant process and design details, including specification sheets and standards currently followed in the plant.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To provide an overview on power generation through various methods
2	To educate on the important power plant measurements and devices.
3	To educate on basic Boiler control techniques.
4	To educate on advanced Boiler control techniques.
5	To educate on the turbine control techniques.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: Review and Brief survey of methods of power generation their construction	Understand
CO2: Compare the measurements in current trends in instrumentation power plant.	Analyze
CO3: Classify the to analysers in power plants in change control strategies when systems are update.	Evaluation
CO4: Construct the instrumentation selection techniques based on operating parameters.	Create
CO5: Design the basic idea about monitoring different parameters like speed, vibration of turbines and their control.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	S	L	M	M	L	M	-	-	-	-	L	S	-
CO2	S	M	M		M	M	-	M	-	-	-	-	M	S	-
CO3	M	S	S	L	-	M	-	M	-	-	-	-	M	M	L
CO4	M	M	S	L	-	M	-	M	-	L	-	-	M	M	L
CO5	M	-	-	L	M	-	-	-	-	-	-	L	M	M	-

S- Strong; M-Medium; L-Low

OVERVIEW OF POWER GENERATION

Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes - UP&I diagram of boiler – Cogeneration.

MEASUREMENTS IN POWER PLANTS

Electrical measurements – Current, voltage, power, frequency, power factor etc. – Non electrical parameters – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Radiation detector – Smoke density measurement – Dust monitor.

ANALYSERS IN POWER PLANTS

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments.

CONTROL LOOPS IN BOILER

Combustion control – Air/fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator control – Distributed control system in power plants – Interlocks in boiler operation.

TURBINE – MONITORING AND CONTROL
Speed, vibration, shell temperature monitoring and control – Steam pressure control – Lubricant oil temperature control – Cooling system.

TEXT BOOKS
1. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 1991.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill, 2001.
3. El-Wakil M.M., "Power Plant Technology", 2nd Edition, Tata McGraw Hill, New Delhi, 2010.

REFERENCE BOOKS
1. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi,1994.. R.K.Jain, 2. 2. 2. Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.
3. Nag P.K., "Power Plant Engineering", 4th Edition, Tata-McGraw Hill Education, New Delhi, 2014.
4. Frederick T. Morse, "Power Plant Engineering", 3rd Edition, Litton Educational Publishing Inc, 1953.
5. R.K. Rajput, "A Text Book of Power Plant Engineering", 4th Edition, Laxmi Publications, 2013.
6. G.D. Rai, "Introduction to Power Plant Technology", 3rd Edition, Khanna Publishers, New Delhi, 2013.
7. G.R. Nagpal, "Power Plant Engineering", 16th Edition, Khanna Publishers, New Delhi, 2012.

COURSE DESIGNERS

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17APEE03	NATIONAL CADET CORPS	Category	L	T	P	Credit
		EEC	0	0	4	2

PREAMBLE

The training curriculum of the NCC is primarily focused towards character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity of exposure/interaction beyond a cadet's immediate environment and thereby enabling them for a brighter and progressive future.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country.
2	To create a human resource of organized, trained and motivated youth, to provide leadership in all walks of life and always available for the service of the nation.
3	To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Explore the importance of NCC in nation building.

CO2. Develop an insight into the religion, cultural and tradition of India.

CO3. Acquaint themselves with the different types of leadership.

CO4. Analyses the need for social service for the development of a society.

CO5. Basic understanding of map sheets and map reading instruments and development of capability to use them to carry out simple map reading.

SYLLABUS

Aims and objectives of NCC, Organization, training and the NCC Song, Incentives.
Drill - Foot Drill, Arms Drill, Ceremonial Drill and Weapon Training
National Integration - Religions, culture, traditions and customs of India, National Integration: Importance and necessity, Freedom struggle and nationalist movements in India.
Personality Development and Leadership - Introduction to personality development, Self-awareness, Communication skills, Leadership traits, Time management.
Disaster Management and Civil Affairs - Civil defense organization and NDMA, Types of emergencies and natural disasters, Assistance during natural and other calamities: Floods, cyclones, earth quakes, and accidents.
Social Awareness and Community Development - Basics of social service and Its need, Rural development programmes, Contribution of youth towards social welfare, Civic responsibility, Causes and prevention of HIV AIDS.
Health and Hygiene - Structure and function of the human body, Hygiene and sanitation, Infectious and contagious diseases and its prevention.
Environment Awareness and Conservation - Natural resources- conservation and management, Water conservation and rain water harvesting
Armed Forces - Basic organization of Armed Forces, Organisation of the Army, Badges and Ranks. Map Reading- Introduction to types of maps and conventional signs.

Map Reading -0 Scales and grid system, Topographical forms and technical terms Relief, contours and gradients, Cardinal points and types of North, Types of bearings and use of service protractor, Prismatic compass and its use and GPS.
Field Craft and Battle Craft - Judging distance, Description of ground, Recognition, description and indication of land marks and targets.
Introduction to Infantry Weapons and Equipment - Characteristics of 7.62mm SLR rifle, ammunition, fire power, Stripping, assembling and cleaning.
Military History - Biographies of renowned generals (Carriappa/Manekshaw),Indian Army war heroes.
Communication - Types of communication, Characteristics of wireless technology (mobile, Wi Fi, etc.)

TEXTBOOKS

1. Cadet Hand Book (Common Subjects), Published by DG NCC.
2. Cadet Hand Book (Specialized Subjects), Published by DG NCC.

REFERENCE BOOKS

1. Grooming Tomorrow's Leaders, Published by DG, NCC.
2. Youth in Action, Published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

COURSE DESIGNERS

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2.	Mr.S.Muthu Selven	Assistant Professor	CSE	muthuselven@avit.ac.in

17APEE04	NATIONAL SERVICE SCHEME	Category	L	T	P	Credit
		EEC	0	0	4	2

PREAMBLE

The service curriculum of the NSS is primarily focused towards character building, inculcating social responsibilities and human values through structured academic syllabi, practical training and opportunity of exposure/interaction beyond a volunteer's thereby enabling them for a brighter and progressive future.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To develop character, leadership, discipline and the ideals of selfless service amongst the youth of the country.
2	To create a human resource of organized, trained and motivated youth always available for the service of the nation.
3.	To practice national integration and social harmony
4.	To identify the needs and problems of the community and involve them in problem-solving

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Improve the quality of educated manpower by fostering social responsibility.

CO2. Develop an insight into the religion, cultural and tradition of India.

CO3. Analyses the need of social service for the development of a society.

CO4. To utilize their knowledge in finding practical solutions to individual and community problems.

SYLLABUS

INTRODUCTION TO NATIONAL SERVICE SCHEME

History and its Objectives – Emblem, Flag, Motto, Song and badge-Organizational structure of N.S.S. at National, State, University and College Levels - Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation**.**

NATIONAL INTEGRATION AND YOUTH LEADERSHIP

Need of National integration - Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Concept of family –Human values- Meaning and role of leadership- Qualities of good leadership- Role of youth in nation building-National youth policy- Youth focused and Youth led organizations

HEALTH, HYGIENE AND SANITATION AND COMMUNITY MOBILISATION

Definition, need and scope of health education- Food and Nutrition-National health programme –

Healthy lifestyle- Home nursing- First aid

Mapping of Community stakeholders- Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization- Youth-adult partnership

NSS REGULAR ACTIVITIES

Introduction - NSS Regular activities - Day campus- Basics of adaptation of village/slums-Methodology of conducting survey- Financial pattern of the scheme- Schemes of GOI-Coordination with different agencies- Maintenance of the diary

NSS SPECIAL CAMPING

Nature and its objectives- Selection of camp site and physical arrangement-Organization of N.S.S. camp through various committees and discipline in the camp -Activities to be undertaken during the N.S.S. camp -Use of the mass media in the N.S.S. activities- Collection and analysis of data- Preparation of Documentation and reports- Dissemination of documents and reports.

COURSE DESIGNERS

S.No	Name of the Facility	Designation	Department	Mail Id
1.	Mr.S.KRISHNARAJ	Asst. Professor	Chemistry/VMKVEC	srajkrishna85@gmail.com
2.	Mr.C.THANGAVEL	Asso. Professor	Mechanical/VMKVEC	ceeteemech@gmail.com
3.	Dr.B. PRABASHEELA	Asso. Professor	Biotechnology/ AVIT	prabasheela@avit.ac.in

17APEE05	**SPORTS AND GAMES INTER COLLEGIATE LEVEL**	Category	L	T	P	Credit
		CC	0	0	2	1

PREAMBLE

To produce good players, by providing Hi-Tech Sports facilities to the Students and to be the top college for Sports in addition to academics in several disciplines of science and engineering.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Demonstrate an understanding of the principles and concepts related to a variety of physical activities
2	Recall and understand the importance of physical activity to a healthy lifestyle
3	Display acquired motor skills necessary to perform a variety of physical activities
4	Apply tactics, strategies and rules in both individual and group situations
5	Recognize and inspire the physical and mental benefits of sports activities.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Respect themselves and correlate their social and physical environment

CO2.Support and encourage others (towards a positive working environment)

CO3.Develop attitudes and strategies that enhance their relationship with others

CO4.Show sensitivity to their own and different cultures.

CO5.Take responsibility for their own learning process and demonstrate engagement with the activity, showing enthusiasm and commitment

LIST OF EVENTS ORGANIZED:

Intramural Activities. (Inter Collegiate tournaments and open college tournaments)
Training and Coaching for inter collegiate tournaments.
Conducting Inter class, inter-department tournament.
Enrolment of students in the concerned sports and games.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jayaraman	Director of Physical Education	Physical Education	jayaraman@vmkvec.edu.in
2	Mr.P.Naveen	Director of Physical Education	Physical Education	naveen@vmkvec.edu.in

17APEE06	**SPORTS AND GAMES INTER UNIVERSITY LEVEL**	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To produce good players, by providing Hi-Tech Sports facilities to the Students and to be the top college for Sports in addition to academics in several disciplines of science and engineering.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Demonstrate an understanding of the principles and concepts related to a variety of physical activities
2	Recall and understand the importance of physical activity to a healthy lifestyle
3	Display acquired motor skills necessary to perform a variety of physical activities
4	Apply tactics, strategies and rules in both individual and group situations
5	Recognize and inspire the physical and mental benefits of sports activities.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Respect themselves and correlate their social and physical environment

CO2.Support and encourage others (towards a positive working environment)

CO3.Develop attitudes and strategies that enhance their relationship with others

CO4.Show sensitivity to their own and different cultures.

CO5.Take responsibility for their own learning process and demonstrate engagement with the activity, showing enthusiasm and commitment

LIST OF EVENTS ORGANIZED:

Extramural Activities. (District, State & Open level Tournaments)
Training and Coaching for inter collegiate tournaments.
Conducting Inter class, inter-department tournament.
Enrolment of students in the concerned sports and games.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jayaraman	Director of Physical Education	Physical Education	jayaraman@vmkvec.edu.in
2	Mr.P.Naveen	Director of Physical Education	Physical Education	naveen@vmkvec.edu.in

17APEE07	SPORTS AND GAMES ALL INDIA INTER UNIVERSITY LEVEL	Category	L	T	P	Credit
		CC	0	0	6	3

PREAMBLE

To produce good players, by providing Hi-Tech Sports facilities to the Students and to be the top college for Sports in addition to academics in several disciplines of science and engineering.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Demonstrate an understanding of the principles and concepts related to a variety of physical activities
2	Recall and understand the importance of physical activity to a healthy lifestyle
3	Display acquired motor skills necessary to perform a variety of physical activities
4	Apply tactics, strategies and rules in both individual and group situations
5	Recognize and inspire the physical and mental benefits of sports activities.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Respect themselves and correlate their social and physical environment

CO2.Support and encourage others (towards a positive working environment)

CO3.Develop attitudes and strategies that enhance their relationship with others

CO4.Show sensitivity to their own and different cultures.

CO5.Take responsibility for their own learning process and demonstrate engagement with the activity, showing enthusiasm and commitment

LIST OF EVENTS ORGANIZED:

Extramural Activities. (South Zone & All India Inter University tournaments & National level)
Training and Coaching for inter collegiate tournaments.
Conducting Inter class, inter-department tournament.
Enrolment of students in the concerned sports and games.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jayaraman	Director of Physical Education	Physical Education	jayaraman@vmkvec.edu.in
2	Mr.P.Naveen	Director of Physical Education	Physical Education	naveen@vmkvec.edu.in