Faculty of Engineering and Technology

REGULATIONS 2021

Programme:

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

Part Time ($3\frac{1}{2}$ Years)

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM

(Semester I to VII)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

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 Electrical and Electronics 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 Computing systems those are innovative and socially acceptable.
PEO3	To motivate the graduates to exhibit professionalism, ethics, communication skills, team work and Application oriented research.

VINAYAKA MISSION'S RESEARCH FOUNDATION
(DEEMED TO BE UNIVERSITY), SALEM

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM FOR REGULATION-2021

Credit Requirement for the Course Categories

Sl. No.	Category of Courses	Types of Courses		Suggested Breakup of Credits (min-max)
1.	A. Foundation Courses (18-24)	Humanities and Social Sciences including Management Courses		9 - 12
2.		Basic Science Courses		9 - 12
3.	B. Professional	Core Courses		61
4.	C. Elective Courses (18-27)	Professional Electives		12 – 15
		Open Electives	Innovation, Entrepreneurship, Skill Development etc.	3 – 6
			Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc.	3 – 6
5.	D. Courses for Presentation of technical Skills related to the specialization	Project Work		8
6.	**E. Mandatory Courses	Yoga and Meditation, Gender Equity and Law, Essence of Indian Traditional Knowledge, Indian Constitution, NCC/NSS/ RRC/ YRC/ Student Clubs/ Unnat Bharat Abhiyan/Swachh Bharat , Sports and Games		Zero Credit Course (Minimum 2 Courses to be Completed other than Yoga and Meditation)
Minimum Credits to be earned				**105**

CURRICULUM

B.E (Part Time) –
ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER
I TO VII

B.E.(Part Time) – ELECTRICAL AND ELECTRONICS ENGINEERING – SEMESTER I TO VII

A. Foundation Courses

Humanities and Social Sciences including Management Courses – Credits (9-12)

SL. NO	COURSE CODDE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1		TOTAL QUALITY MANAGEMENT	MANAG	FC-HS	3	0	0	3	NIL
2		ENGINEERING MANAGEMENT AND ETHICS	MANAG	FC-HS	3	0	0	3	NIL
3		OPERATIONS MANAGEMENT	MANAG	FC-HS	3	0	0	3	NIL
4		UNIVERSAL HUMAN VALUES - UNDERSTANDING HARMONY	ENG	FC-HS	3	0	0	3	NIL
		Basic Science Courses – Credits (9-12)							
1.		ENGINEERING MATHEMATICS	MATH	FC-BS	2	1	0	3	NIL
2.		DIFFERENTIAL EQUATIONS AND TRANSFORMS	MATH	FC-BS	2	1	0	3	ENGINEERING MATHEMATICS
3.		SMART MATERIALS AND NANO TECHNOLOGY	PHY	FC-BS	3	0	0	3	NIL
4.		PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	MATH	FC-BS	2	1	0	3	DIFFERENTIAL EQUATIONS AND TRANSFORMS
5		ENVIRONMENTAL SCIENCES	CHEM	FC-BS	3	0	0	3	NIL

B.E (Part Time) – ELECTRICAL AND ELECTRONICS ENGINEERING – SEMESTER I TO VIII
B. Professional Courses
Core Courses – Credits (61)
SL. NO	**COURSE CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		ELECTRIC CIRCUIT ANALYSIS (THEORY AND PRACTICALS)	EEE	CC	3	0	2	4	NIL
2.		SEMICONDUCTOR DEVICES AND CIRCUITS	ECE	CC	3	0	0	3	NIL
3.		ELECTRICAL MACHINES – I	EEE	CC	3	0	0	3	NIL
4.		ELECTRICAL MACHINES – II	EEE	CC	3	0	0	3	ELECTRICAL MACHINES – I
5.		ELECTROMAGNETIC THEORY	EEE	CC	3	0	0	3	ENGINEERING MATHEMATICS
6.		MEASUREMENT AND INSTRUMENTATION (THEORY AND PRACTICALS)	EEE	CC	3	0	2	4	NIL
7.		ANALOG AND DIGITAL CIRCUITS (THEORY AND PRACTICALS)	ECE	CC	3	0	2	4	SEMICONDUCTOR DEVICES AND CIRCUITS
8.		POWER ELECTRONICS AND DRIVES (THEORY AND PRACTICALS)	EEE	CC	3	0	2	4	SEMICONDUCTOR DEVICES AND CIRCUITS
9.		TRANSMISSION AND DISTRIBUTION	EEE	CC	3	0	0	3	ELECTROMAGNETIC THEORY
10.		CONTROL SYSTEMS	EEE	CC	3	0	0	3	DIFFERENTIAL EQUATIONS AND TRANSFORMS
11.		POWER SYSTEM ANALYSIS	EEE	CC	3	0	0	3	TRANSMISSION & DISTRIBUTION
12.		MICROCONTROLLER BASED SYSTEM DESIGN AND EMBEDDED SYSTEM DESIGN (THEORY AND PRACTICALS)	ECE	CC	3	0	2	4	ANALOG AND DIGITAL CIRCUITS
13.		POWER SYSTEM PROTECTION AND SWITCHGEAR	EEE	CC	3	0	0	3	ELECTRICAL MACHINES – I & ELECTRICAL MACHINES – II
14.		EHVAC AND DC POWER TRANSMISSION	EEE	CC	3	1	0	4	NIL
15.		PHOTOVOLTAIC ENERGY CONVERSION	EEE	CC	3	0	0	3	NIL
16.		SEMICONDUCTOR DEVICES AND CIRCUITS LAB	ECE	CC	0	0	4	2	NIL
17.		ELECTRICAL MACHINES – I LAB	EEE	CC	0	0	4	2	NIL
18.		ELECTRICAL MACHINES – II LAB	EEE	CC	0	0	4	2	NIL
19.		CONTROL SYSTEMS LAB	EEE	CC	0	0	4	2	NIL
20.		POWER SYSTEM SIMULATION LAB	EEE	CC	0	0	4	2	NIL

		B.E.(Part Time) – ELECTRICAL AND ELECTRONICS ENGINEERING – SEMESTER I TO VII							
		C. Elective Courses							
		Professional Elective - Credits(12-15)							
SL. NO	COURSE CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		HIGH VOLTAGE ENGINEERING	EEE	EC-PS	3	0	0	3	NIL
2.		POWER SYSTEM OPERATION AND CONTROL	EEE	EC-PS	3	0	0	3	NIL
3.		POWER QUALITY AND FACTS	EEE	EC-PS	3	0	0	3	NIL
4.		SPECIAL ELECTRICAL MACHINES	EEE	EC-PS	3	0	0	3	NIL
5.		WIND ENERGY CONVERSION SYSTEMS	EEE	EC-PS	3	0	0	3	NIL
6.		ELECTRIC VEHICLES	EEE	EC-PS	3	0	0	3	NIL
7.		DISTRIBUTED GENERATION AND MICROGRIDS	EEE	EC-PS	3	0	0	3	NIL
8.		POWER CONVERTERS ANALYSIS AND DESIGN	EEE	EC-PS	3	0	0	3	NIL
9.		RENEWABLE ENERGY SOURCES	EEE	EC-PS	3	0	0	3	NIL
10.		ENERGY CONVERSION AND STORAGE TECHNOLOGIES	EEE	EC-PS	3	0	0	3	NIL
11.		POWER SYSTEM AND SMART GRID	EEE	EC-PS	3	0	0	3	NIL
12.		DIGITAL SIGNAL PROTECTION FOR POWER SYSTEMS	EEE	EC-PS	3	0	0	3	NIL
13.		DESIGN OF ELECTRICAL APPARATUS	EEE	EC-PS	3	0	0	3	NIL
14.		HVDC TRANSMISSION SYSTEMS	EEE	EC-PS	3	0	0	3	NIL
15.		ENERGY AUDIT AND CONSERVATION	EEE	EC-PS	3	0	0	3	NIL

Open Elective Courses – Innovation, Entrepreneurship, Skill Development etc.   - Credits (3-6)

SL. NO	COURSE CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	MANAG	OE-IE	3	0	0	3	NIL
2.		NEW VENTURE PLANNING AND MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
3.		SOCIAL ENTREPRENEURSHIP	MANAG	OE-IE	3	0	0	3	NIL
4.		ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	MANAG	OE-IE	3	0	0	3	NIL
5.		INTELLECTUAL PROPERTY RIGHTS	MANAG	OE - IE	3	0	0	3	NIL
6.		LIFE SKILLS	MANAG	OE-IE	3	0	0	3	NIL

Open Elective Courses – Electives from other Technical and /or Emerging Courses Credits (3-6)

SL. NO	COURSE CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		PRINCIPLES OF BIOMEDICAL INSTRUMENTATION	BME	OE-EA	3	0	0	3	NIL
2.		BIOSENSORS AND TRANSDUCERS	BME	OE-EA	3	0	0	3	NIL
3.		INTRODUCTION TO BIOFUELS	BTE	OE-EA	3	0	0	3	NIL
4.		FOOD AND NUTRITION TECHNOLOGY	BTE	OE-EA	3	0	0	3	NIL
5.		DISASTER RISK MANAGEMENT	CIVIL	OE-EA	3	0	0	3	NIL
6.		MUNICIPAL SOLID WASTE MANAGEMENT	CIVIL	OE-EA	3	0	0	3	NIL
7.		FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	CSE	OE-EA	3	0	0	3	NIL
8.		INTRODUCTION TO INTERNET OF THINGS	CSE	OE-EA	3	0	0	3	NIL
9.		CYBER SECURITY	CSE	OE-EA	3	0	0	3	NIL
10.		DESIGN OF ELECTRONIC EQUIPMENT	ECE	OE-EA	3	0	0	3	NIL
11.		INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	ECE	OE-EA	3	0	0	3	NIL
12.		3D PRINTING AND ITS APPLICATIONS	MECH	OE-EA	3	0	0	3	NIL
13.		INDUSTRIAL ROBOTICS	MECH	OE-EA	3	0	0	3	NIL
14.		BIOMOLECULES – STRUCTURE AND FUNCTION	PE	OE-EA	3	0	0	3	NIL
15.		PHARMACOGENOMICS	PE	OE-EA	3	0	0	3	NIL

B.E.(Part Time) – ELECTRICAL AND ELECTRONICS ENGINEERING – SEMESTER I TO VII									
Project work, Credits - (8)									
SL. NO	COURSE CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		PROJECT WORK	EEE	PI-P	0	0	16	8	NIL

MANDATORY COURSES (NO CREDITS) (NOT INCLUDED FOR CGPA CALCULATIONS)									
SL. NO	COURSE CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.		YOGA AND MEDITATION	PHED	AC	0	0	2	0	NIL
ANY TWO OF THE FOLLOWING COURSES									
2.		GENDER EQUITY AND LAW	LAW	AC	0	0	2	0	NIL
3.		ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	GEN	AC	0	0	2	0	NIL
4.		INDIAN CONSTITUTION	LAW	AC	0	0	2	0	NIL
5.		NCC/NSS/RRC/YRC/STUDENT CLUBS/UNNAT BHARAT ABHIYAN/ SWACTH BHARAT	GEN	AC	0	0	2	0	NIL
6.		SPORTS AND GAMES	PHED	AC	0	0	2	0	NIL

	TOTAL QUALITY MANAGEMENT	Category	L	T	P	Credit
		FC - HS	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: Not Required

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

Concept of Quality and Quality Management - Determinants of quality of product & service - Quality costs – Analysis Techniques for Quality Costs – TQM Principles and Barriers & Implementation –Leadership – Concepts- Role of Top Management- Quality Council – Quality statements: vision, mission, Policy - SMART Goal setting -- Strategic Planning.

TQM PRINCIPLES AND PHILOSOPHIES

Customer satisfaction – Perception of Quality- Customer Complaints - Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment – Teams - Recognition and Reward- Performance Appraisal - Continuous Process Improvement : Deming's Philosophy - Juran's Trilogy - PDSA Cycle- Taguchi Quality Loss Function - 5S principles and 8D methodology - Kaizen - Basic Concepts.

STATISTICAL PROCESS CONTROL (SPC) & PROCESS CAPABILITY

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

TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT

Benchmarking – Reasons - Process- Quality Function Deployment (QFD) – House of Quality- QFD Process- Benefits- Total Productive Maintenance (TPM) – Concept- Improvement Needs- FMEA – Stages of FMEA - Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

QUALITY SYSTEMS

Introduction to IS/ISO 9004:2000 – quality management systems – Elements- Implementation of Quality System - Documentation- Quality Auditing- 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:

S.No	Name of the Faculty	Designation	Department	Mail ID

1	A. Mani	Associate Professor	Management Studies	mani@vmkvec.edu.in
2	Dr. V. Sheela Mary	Associate Professor	Management Studies	sheelamary@avit.ac.in

ENGINEERING MANAGEMENT AND ETHICS	Category	L	T	P	Credit
	FC-HS	3	0	0	3

PREAMBLE:
Engineering management provides technological problem-solving ability of engineering and the organizational to oversee the operational performance of complex engineering enterprises to Engineers. Engineers require honesty, impartiality, fairness, and equity, and dedication to the protection of the public health, safety, and welfare. Ethics emphasises the importance of moral issues, rights and duties of the employees through basic ethics confronting individuals and organizations engaged. It also emphasise values that are morally desirable in engineering practice and research. It allows them to understand various occupational crimes and learn the moral leadership.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To Understand the principles of planning at various levels of the organisation.

2. To analyse and practice the concepts of organizing, staffing to higher productivity.

3. To apply the concepts related to directing and controlling.

4. To understand and apply the case studies to practice code of ethics in organisation.

5. To apply the ethical principles in working environment.

COURSE OUTCOMES:

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

CO1: Understand the importance of planning principles in organization	Understand
CO2: Apply the various strategies of organising and staffing process.	Apply
CO3: Analyse various leadership skills and control techniques for shaping the organization.	Analyse
CO4: Understand and apply best ethical practices in organisation	Analyse
CO5: Analyse and Apply relevant ethical practices in engineering.	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	L	S	M	M	L	S	S	S	S	-	-	-
CO2	M	L	L	-	M	M	M	L	M	S	M	M	-	-	-
CO3	M	M	L	-	M	M	M	L	L	S	S	M	-	-	-
CO4	L	M	-	M	-	M	S	S	S	S	-	M	-	-	-
CO5	M	M	-	L	-	M	S	S	S	S	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS:
PLANNING
Nature and purpose of planning – planning process – types of planning – objectives – setting -Objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

ORGANISING
Nature and purpose – Formal and informal organization – organization chart – organization structure– types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

DIRECTING
Foundations of individual and group behavior – motivation – motivation theories – motivational - Techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – Communication – process of communication – barrier in communication – effective communication – communication and IT.

CONTROLLING

System and process of controlling – budgetary and non-budgetary control techniques – use of Computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

ETHICS IN ENGINEERING

Moral dilemmas -Uses of Ethical Theories- Engineering as Social Experimentation- Engineer's Responsibility For Safety-Codes of Ethics-Challenger - Employed Engineers Rights and Duties- Collective Bargaining - Occupational Crime - Global Issues- Multinational Corporation- Technology transfer - Engineers as managers - Consulting Engineers - Expert Witness-Moral Leadership.

TEXT BOOKS:

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.
3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global & Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson South-western, 7th edition, 2007.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	mail id
1	M. Manickam	Associate Professor	Management Studies	manickam@vmkvec.edu.in
2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

XXX	OPERATIONS NANAGEMENT	Category	L	T	P	Credit
		HSS	3	0	0	3

Preamble

The contemporary uncertain business environment is forcing the organizations to adopt the latest tools, techniques and strategies for managing their resources in the most effective and efficient fashion. The topics of the course deals with the management of resources and activities that lead to production of goods of right quality, in right quantity, at right time and place in the most cost- impressive manner. The course focuses on the basic concepts, issues, and techniques adopted worldwide for efficient and effective operations. The topics include operations strategy, product design and development, forecasting, facility planning and layout, aggregate production planning, capacity planning, project management, production control, materials management, inventory and quality management, JIT and Kanban System.

Prerequisite

Not Required

Course Objectives

1. To understand the Fundamentals of Operations.
2. To Understand the importance of Job Design and their relationship towards Efficiency.
3. To understand the importance of Production, Planning and Control.
4. To evaluate the material requirement with the techniques.
5. To impart the Operation management Techniques to get rid of the Competitive advantage.

Course Outcomes

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

CO1. Understand the importance of Operations Managenet	Understand
CO2. Evaluating the various organisation and staffing functions.	Evaluate
CO3. Understand the Impoprtance Of Production Planning and Control.	Understand
CO4. Evaluate the Various Operation Management Techniques.	Evaluate
CO5. Analyse and Evaluating the various Inventory Management Techniques to take Competitive advantage	Analyse

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

UNIT- I INTRODUCTION TO OPERATIONS MANAGEMENT 9 Hours

Operations Management- Nature & Scope – Evolution of Operatons Management – Types of Production System, Operations Stratergy – Product Life Cycle- Value Engineering concepts - Make or Buy Decision- Recent Trends in Operations Management- Plant Capacity - Plant Location & Factors.

UNIT- II JOB DESIGN & MATERIAL HANDLING 9 Hours

Layout- Princilpes of Layout- factory-Basic types of layout product layout, group technology layout, fixed position layout, Retail service layout.Principles of material handling-Material handling equipment.Job-design: Effective job design- Combining engineering and behavioral approaches, Work measurement- method analysis- Ergonomics-Case studies.

UNIT- III PRODUCTION, PLANNING & CONTROL 9 Hours

Basic types of production- Interminent, Batch, continuous-Routing, Scheduling, Activating and Monitoring- Production Planning and Control, Process Planning, Aggregate Production Planning, Capacity Planning: Introduction, Capacity Planning

UNIT IV OPERATION TECHNIQUES 9 Hours

Project Scheduling, Network Diagrams, Critical Path Method (CPM), Critical Path Method: Problems, Critical Path Method. Program Evaluation and Review Technique (PERT), PERT Problems, PERT Problems, Time Cost Trade Off Production Control, Sequencing, Sequencing Problems-I, Sequencing Problems- II, Master Production Scheduling- Concept of Quality, Total Quality Management (TQM), Total Productive Maintenance (TPM), Statistical Quality Control (SQC), Six Sigma.

UNIT- V INVENTROY MANAGEMENT 9 Hours

Materials Management, Inventory Control, Economic Order Quantity (EOQ) Models, Economic Order Quantity (EOQ): Problems, Production Quantity- Just in Tir [...] ment Planning (MRP)-I, Materials Requirement Planning (MRP)-II, [...]

TOTAL HOURS : 45 HOURS

TEXT BOOKS

1. The Encyclopedia of Operations Management: A Field Manual and Glossary of Operations Management ARTHUR V HILL 1st Edition
2. Handbook of Industrial Engineering: Technology and Operations Management, Gavriel Salvendy 3rd Edition.
3. Quality and Operations Management: Revised Edition.
4. Operations Management: Theory and Practice by Mahadevan
5. Production and Operations Management by PANNEERSELVAM. R.

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. B. Rajnarayanan	Associate Professor & Head	Management Studies	rajnarayanan@vmkvec.edu.in
2	Mr. T. Thangaraja	Associate Professor	Management Studies	thangaraja@avit.ac.in

	SOFT SKILLS FOR ENGINEERS	Category	L	T	P	Credit
		FC-HS	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 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 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 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	-	S	-	S	S	-	S
CO2	-	-	-	-	-	-	L	-	-	S	-	S	-	-	S
CO3	-	-	-	L	-	-	-	-	-	-	-	L	-	M	-
CO4	-	-	-	-	-	M	-	L	M	S	L	S	S	M	S
CO5	M	-	L	S	-	-	-	-	-	-	-	S	M	-	S

S- Strong; M-Medium; L-Low

Course Code	Course Title	Category	L	T	P	C
	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	**FC - HS**	**3**	**0**	**0**	**3**

Course Objectives:

1. Development of a holistic perspective based on self- exploration

2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

3. Strengthening of self-reflection.

4. Development of commitment and courage to act.

UNIT I Introduction

Value Education, Definition, Concept and Need for Value Education-Content and Process of -basic guidelines for Value Education -Self exploration - Happiness and Prosperity as parts of Value Education.

UNIT II Understanding Harmony in the Human Being

Harmony in Myself-Understanding human being as a co-existence of the sentient 'I' and the material 'Body'-Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. - Understanding the Body as an instrument of 'I (I being the doer, seer and enjoyer)-Understanding the characteristics and activities of 'I' and harmony in 'I'-Understanding the harmony of I with the Body-Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

UNIT III Understanding Harmony in the Family and Society

Harmony in Human-Human Relationship -meaning of Justice - Trust and Respect -Difference between intention and competence- respect and differentiation; the other salient values in relationship 4.Understanding the harmony in the society - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals –Gratitude

UNIT IV Understanding Harmony in the Nature and Existence

Whole existence as Coexistence -.Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature-Holistic perception of harmony at all levels of existence.

UNIT V Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values -.Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order- Competence in professional ethics

Total Hours : 45 Hours

Text Book
1.Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
Reference Books
1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

COURSE DESIGNERS				
S.NO	COURSE INSTRUCTOR	DESIGNATION	NAME OF THE INSTITUTION	MAIL ID
1	Dr.S.P.Sangeetha	Vice Principal(Academics)	AVIT	sangeetha@avit.ac.in
2	Dr.Jennifer G Joseph	HoD-H&S	AVIT	Jennifer@avit.a.cin

	ENGINEERING MATHEMATICS	Category	L	T	P	Credit
		FC- BS	2	1	0	3

PREAMBLE

The driving force in Engineering Mathematics is the rapid growth of technology and the sciences. Matrices had been found to be of great utility in many branches of engineering applications such as theory of electric circuits, aerodynamics, and mechanics and so on. Many physical laws and relation can be expressed mathematically in the form of differential equations. Based on this we provide a course in matrices, calculus and differential equations. Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To recall the advanced matrix knowledge to Engineering problems.
2	To equip themselves familiar with the functions of several variables.
3	To improve their ability in solving geometrical applications of differential calculus problems
4	To examine knowledge in multiple integrals.
5	To improve their ability in Vector calculus.

COURSE OUTCOMES

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

CO1.Apply the concept of orthogonal reduction to diagonalise the given matrix	Apply
CO2.Find the radius of curvature, circle of curvature and centre of curvature for a given curve.	Apply
CO3. Classify the maxima and minima for a given function with several variables, through by finding stationary points	Apply
CO4. Find double integral over general areas and triple integral over general volumes	Apply
CO5. Apply Gauss Divergence theorem for evaluating the surface integral.	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	--	--	--	--	L	--	--	--	M	--	--	--
CO2	S	S	M	--	--	--	--	L	--	--	--	M	--	--	--
CO3	S	S	M	--	--	--	--	L	--	--	--	M	--	--	--
CO4	S	S	M	--	--	--	--	L	--	--	--	M	--	--	--
CO5	S	S	M	--	--	--	--	L	--	--	--	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).

DIFFERENTIAL CALCULUS&PARTIAL DERIVATIVES :

Curvature – Cartesian and Parametric Co-ordinates – Centre and radius of curvature – Circle of curvature.

Partial Derivatives – Total Differentiation – Maxima and Minima -Constrained Maxima and Minima by Lagrangian Multiplier Method,

ORDINARY DIFFERENTIAL EQUATIONS:

Solutions of second and third order linear ordinary differential equation with constant coefficients – Method of variation of parameters -Simultaneous first order linear equations with constant coefficients.

MULTIPLE INTEGRALS:

Introduction of multiple integration by examples of Double and Triple integral-Evaluation of double and Triple Integration(in both Cartesian and polar coordinates)-Change of order of integration

VECTOR CALCULUS:

Scalar and vector point functions, Gradient, divergence, curl, Solenoidal and irrotational vectors, Vector identities (without proof),Normal and Directional derivatives, Solenoidal and irrotational field, Integration of vectors: Definition of Line, surface and volume integrals, Green's, Gauss divergence and Stoke's theorems (Statements only)

TEXT BOOKS:
1. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill Education Pvt, New Delhi (2019).
2. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi (2020).
3. Kreyszig E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt. Ltd., Singapore (2012).

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

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. A.K.Bhuvaneswari	Assistant Professor	Mathematics	bhuvaneswari@avit.ac.in
2	Dr.G.Selvam	Associate Professor	Mathematics	selvam@vmkvec.edu.in

	DIFFERENTIAL EQUATIONS AND TRANSFORMS	Category	L	T	P	Credit
		FC- BS	2	1	0	3

PREAMBLE

A signal is said to be a continuous time signal if it is available at all instants of time. 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. These are three important classes of transformation methods available for continuous time systems. They are Laplace Transform, Fourier series and Fourier Transform. Similarly, Z- transform plays an important role in analysis of linear discrete time signals. Transform techniques are very important tool in the analysis of signals. Also To expose the students to the basics of wavelet theory and to illustrate the use of wavelet processing in engineering fields.

PREREQUISITE

Engineering Mathematics

COURSE OBJECTIVES

1	Learn to use Fourier series to represent periodical physical phenomena in engineering analysis
2	To understand how the Fourier series is extended to aperiodic signals in the form Fourier transform
3	To understand the properties of Z-Transform and associating the knowledge of properties of ROC in response to different operations on discrete signals.
4	To learn Laplace transform and it Inverse methods to solve differential transforms and integral transforms
5	To understand the terminology that are used in the wavelet's literature

COURSE OUTCOMES

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

CO1. Explain fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.	Apply
CO2. Demonstrate Fourier Transform as a tool for solving integral equations	Apply
CO3. Solve difference equations by using Z transform techniques.	Apply
CO4. Understand the concept of Laplace transform and inverse Laplace transform of various functions and its application to solve ordinary differential equations.	Apply
CO5. Understand how to use the modern signal processing tools using signal spaces, bases, operators and series expansions.	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	--	--	--
CO2	S	M	S	M	--	--	--	L	--	--	--	M	--	--	--
CO3	S	M	S	M	--	--	--	L	--	--	--	M	--	--	--
CO4	S	M	S	M	--	--	--	L	--	--	--	M	--	--	--
CO5	S	M	S	M	--	--	--	L	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

Syllabus

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.

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.

WAVELET TRANSFROMATION:
Classes of wavelets: Haar, Daubechies, bi-orthogonal. Continuous Wavelet Transform (CWT): CWT and its Properties, Discrete Wavelet Transform- Haar scaling function - Nested spaces - Wavelet function- Designing orthogonal wavelet systems: Daubechies – Coiflet - Symlet wavelet system coefficients- Signal decomposition using DWT.

TEXT BOOKS:
1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
2. K. P. Soman, K. I. Ramachandran, "Insight into Wavelets: From Theory to Practice", Third Edition, PHI (2004).

REFERENCES:
1. "Engineering mathematics I & II", by Department of Mathematics, VMKVEC (Salem) & AVIT (Chennai), (2017).
2. Dr. A. Singaravelu, "Transforms and Partial differential Equations", 18th Edition, Meenakshi Agency, Chennai (2013).
3. R. M. Rao and Ajit S. Bopardikar, "Wavelet Transform, Introduction to theory and Applications", Addison-Wesley (1998).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. L. Tamilselvi	Professor	Mathematics	ltamilselvi@avit.ac.in
2	Dr. M. Vijayarakavan	Associate Professor	Mathematics	vijayarakavan@vmkvec.edu.in

	SMART MATERIALS AND NANOTECHNOLOGY	Category	L	T	P	C
	Total Contact Hours: 45	FC- BS	3	0	0	3
	Prerequisite: Physical Sciences					

Preamble:

This syllabus enables the students to learn the applications of smart materials and uses of various smart engineering devices. The syllabus also discusses about the nanomaterials, their unique properties and applications in various fields.

Course Objectives:	
1	Gain the knowledge about the concepts of smart systems and various smart materials.
2	Realize about the smart sensor materials which are used for Industrial Applications.
3	Understand about the Industrial application oriented Smart materials' Actuators.
4	To learn the properties and classifications and importance of Nanomaterials
5	Understand the characteristic features of materials at nanoscale and their potential applications

COS	Course Outcomes: On the successful completion of the course, students will	
CO1	Learn the smart-properties of various functional materials	Learn
CO2	understand the applications of different smart materials as sensors	Understand
CO3	understand the applications of different smart materials as actuators	Understand
CO4	Gather knowledge on unique properties of nanomaterials	Learn
CO5	Use of Nanomaterials for industrial applications	Acquire
CO6	Gain knowledge about nanomaterials in health care industry	

Mapping with Programme Outcomes and Programme Specific Outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	POS1	POS2	POS3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	S	S	S	M	-	-	-	-	-	-	S	-	-	-
CO3	S	M	S	S	-	-	-	-	-	-	-	S	-	-	-
CO4	S	S	S	S	M	-	-	-	-	-	-	S	-	-	-
CO5	S	S	S	S	-	-	-	-	-	-	-	S	-	-	-
CO6	S	M	M	S	M	-	-	-	-	-	-	S	-	-	-

S – strong, M- Medium, L - Low

Syllabus	
UNIT: I	9 Hours
Overview of Smart Materials: Introduction to Smart materials –piezoelectric materials – piezoelectricity – magnetostriction materials – magnetostriction effect– shape memory alloys (SMA) – photoelastic materials – photoelasticity.	
UNIT: II	9 Hours
Smart material based sensors: Introduction to sensing technology - electric and magnetosrictive sensors - SMA based sensors - Infrared sensors – stress analysis by photoelastic sensors- Industrial Applications of smart sensors: Accelerometer and Biological DNA sensors.	
UNIT: III	9 Hours
Smart Materials For Actuators: Introduction to smart actuators - piezoelectric actuators - magnetostrictive actuators - SMA based actuators - polymeric and carbon nanotubes based low power actuators –Industrial Applications: robotic artificial muscles , materials for bone substitutes and tissue replacement implants - smart polymeric materials for skin engineering	
UNIT: IV	9 Hours
Materials in Nanoscale: Historical development of nanomaterials - Unit and dimensions - Classifications of nanomaterials - quantum dots, nanowires, ultra-thin films, nanoparticles, multilayered materials. Length Scales involved and effect on properties: mechanical, electronic, optical, magnetic and thermal properties.	
UNIT: V	9 Hours
Selected Applications of Nanomaterials: Medical diagnostics – nanomedicine – targeted drug delivery – Biosensors; Information storage – nanocomputer – molecular switch – single electron transistors; design and fabrication of MEMS and NEMS devices.	

TEXT BOOKS

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2015.
2. Fundamental of Smart Materials, Editor: Mohsen Shahinpoor, RSC Publishers 2020
3. Charles P. Poole, Jr. and Frank J Ownes, "Introduction to Nanoscience and Nanotechnology", Wiley-Interscience Inc., Publication, 1st Edition, 2020.
4. Smart Material Systems And Mems Design And Development Methodologies by Vijay K Varadan, WILEY INDIA 2014.

REFERENCE BOOKS

1. Pillai S.O., Solid State Physics, 9th Edition, New Age International (P) Ltd., Publishers, 2020.
2. William D. Callister Jr., David G. Rethwisch., Materials Science and Engineering: An Introduction, 10th Edition, Wiley Publisher, 2018.
3. Nanotechnology, Second eition, M. A. Shah and K. A. Shah, Wiley Publishers 2019.
4. Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009.

COURSE DESIGNERS			
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr. B. DHANALAKSHMI	Asso. Professor	Physics	Dhanalakshmi.phy@avit.ac.in
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3	Dr. R. N. VISWANATH	Professor	Physics	rnviswanath@avit.ac.in

	PARTIAL DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA	Category	L	T	P	Credit
		FC- BS	2	1	0	3

PREAMBLE

Impart knowledge about the subject of a single variable and multivariable. The focus of the course will be the study of the application of partial differential equations. The course also gives the opportunity to the learner to understand linear algebra and its application to engineering.

PREREQUISITE

Differential Equations and Transforms

COURSE OBJECTIVES

1	Familiarize themselves with the functions of a variety of variables.
2	To familiar with applications of partial differential equations
3	To have the knowledge of vector space & subspaces
4	To have an idea of inner product spaces over the field of complex numbers
5	Understand linear transformation and its properties

COURSE OUTCOMES

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

CO1. Form the partial differential equations and find its solutions	Apply
CO2. Apply the partial differential equations in a vibration of strings; heat-passing a rod and two-dimensional heat conduction problems.	Apply
CO3. Understand the concept of vector space & subspace and to find the dimension of a vector	Apply
CO4. Understand inner product space concepts and apply the concept in various linear system related problems.	Apply
CO5. Compute the linear transformations and find matrices of general linear transformations	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	L	--	--	--	L	--	--	--	M	--	--	--
CO2	S	S	M	L	--	--	--	L	--	--	--	M	--	--	--
CO3	S	S	M	L	--	--	--	L	--	--	--	M	--	--	--
CO4	S	S	M	L	--	--	--	L	--	--	--	M	--	--	--
CO5	S	S	M	L	--	--	--	L	--	--	--	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

APPLICATION OF PARTIAL DIFFERENTIAL EQUATIONS:
Method of separation of variables – Solutions of one-dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates

VECTOR SPACES:
Vectors in two-dimensional space and n dimensional space, subspaces and spanning sets properties of vector space, Linear combination of vectors, Linear independence and dependence of vectors, basis and dimension

INNER PRODUCT SPACES:
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations -Least square approximation

LINEAR TRANSFORMATION:
 Linear transformations, linear operators, Properties of Linear Transformation, Algebra of Linear transformation, Matrix Representation of linear transformation, Linear map Associated with Linear Transformation

TEXT BOOKS:
1. Grewal, B.S., "Higher Engineering Mathematics", 35th Edition, Khanna Publishers, Delhi (2012).
2. Kennath M. Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, Pearson India Publishing, New Delhi, (2015).

REFERENCES:

1. Dr.A. Singaravelu, "Linear Algebra and Partial Differential Equations", Meenakshi Agencies, Chennai (2019).
2. Kreyszig, E., "Advanced Engineering Mathematics", (8th Edition), John Wiley and Sons, (Asia) Pvt. Ltd., Singapore (2012).
3. Dr.Gunadhar Paria, "Linear Algebra", New Central Book Agency (P) Ltd (2012).

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.V.T.Lakshmi	Associate Professor	Mathematics	lakshmivt@vmkvec.edu.in
2	Ms. S.Sarala	Associate Professor	Mathematics	sarala@avit.ac.in

	ENVIRONMENTAL SCIENCES (Common to All Branches)	Category	L	T	P	Credit
		FC-BS	3	0	0	3

Environmental science is an interdisciplinary field that integrates physical, chemical, biological, and atmospheric sciences. Environmental studies deals with the human relations to the environment and societal problems and conserving the environment for the future. Environmental engineering focuses on the various issues of environment and its management for sustainable development by improving the environmental quality in every aspect.

PREREQUISITE
                    NIL

COURSE OBJECTIVES

1	To inculcate the knowledge of significance of environmental studies and conservation of the natural resources.
2	To acquire knowledge of ecosystem, biodiversity, it's threats and the need for conservation
3	To gain knowledge about environmental pollution, it's sources, effects and control measures
4	To familiarize the legal provisions and the national and international concern for the protection of environment
5	To be aware of the population on human health and environment, role of technology in monitoring human health and environment.

COURSE OUTCOMES

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

CO1. Understand the importance of environment and alternate energy resources	Understand
CO2. Initiate the awareness and recognize the social responsibility in ecosystem and biodiversity conservation	Apply
CO3. To develop technologies to analyse the air, water and soil pollution and solve the problems	Apply
CO4. To evaluate the social issues and apply suitable environmental regulations for a sustainable development	Evaluate
CO5. To identify and analyse the urban problems, population on human health and environment	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	S	M	L	-	-	S	S	S	-	-	-	S	-	-	-
CO2	S	M	M	-	-	S	S	S	-	-	-	S	-	-	-
CO3	S	L	M	-	-	S	S	S	-	-	-	S	-	-	-
CO4	S	S	S	L	-	S	S	S	-	-	-	S	-	-	-
CO5	S	S	S	M	-	S	S	S	-	-	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS
UNIT –I ENVIRONMENT AND NATURAL RESOURCES
Environment - Definition, scope & importance - Public awareness- Forest resources- Use and over-exploitation, deforestation, case studies- Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems –Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, Agriculture- effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, Scope & role of engineers in conservation of natural resources.

UNIT –II ECOSYSTEMS AND BIO – DIVERSITY
Ecosystem - Definition, structure and function - Food chain, food web, ecological pyramids-Introduction, types, characteristics, structure and function of forest and Aquatic ecosystems – pond and sea, Introduction to biodiversity, Levels of biodiversity: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – hot-spots of biodiversity –Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT –III ENVIRONMENTAL POLLUTION
Pollution - Definition, causes, effects and control measures of Air, Water and Land pollution, Solid waste- solid waste Management,–Disaster management: Floods, earthquake, cyclone, landslides and tsunamis - Clean technology options, Low Carbon Life Style.

UNIT-IV SOCIAL ISSUES AND ENVIRONMENT
6 hrs
Sustainable Development- Water conservation – rain water harvesting, watershed management - Resettlement and rehabilitation of people , case studies –Climate change - Global warming - Acid rain - Ozone depletion- Environment Protection Act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act- Pollution Control Board-central and state pollution control boards.

UNIT-V HUMAN POPULATION AND ENVIRONMENT
Population – Population growth & Population Explosion –Family welfare programme - Environment & human health - Human rights – Value education –AIDS/HIV, Role of information technology in

environment and human health.

TEXT BOOK
1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.
2. Erach Bharucha "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India
3. Benny Joseph "Environmental Science and Engineering", Tata Mc Graw- Hill, New Delhi

REFERENCES:
1.Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.
2. Anubha Kaushik and C.P Kaushik "Perspectives of Environmental Studies", New age international publishers.
3. Trivedi R.K. "Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II, Enviromedia.
4. Environmental Science and Engineering by Dr. J. Meenambal, MJP Publication, Chennai Gilbert M. Masters: Introduction to Environmental Engineering and Science , Pearson EducationPvtLtd., II Edition, ISBN 81-297-0277-0,2004.
5. Miller T.G.Jr. Environmental Science Wads worth Publishing. Co.
6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology, Blackwell Science.

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1.	Dr. K. Sanghamitra	sanghamitra.chemistry@avit.ac.in
2.	A. Gilbert Sunderraj	gilbertsunderraj@vmkvec.edu.in

	ELECTRIC CIRCUIT ANALYSIS (THEORY & PRACTICALS)	Category	L	T	P	Credit
		CC	3	0	2	4

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 – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES

1	To understand the basic circuit parameter and formulate the mathematical model of circuits using basic laws.
2	Gain knowledge to solve DC and AC circuits using network theorems.
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 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. Describe the various circuit laws and sources	Remember
CO2. Apply Mesh, Nodal analysis to solve DC circuits	Apply
CO3. Analyze of AC and DC circuits using various network theorems	Analyze
CO4. Discuss the basic concepts of Resonance circuits and its components.	Understand
CO5. Explain Coupled circuits with help of Inductance	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	S	L	M	L	-	M	S	M	M	-	-	-
CO2	S	S	M	S	L	-	-	-	-	-	-	-	-	-	-
CO3	S	M	-	S	S	-	M	-	M	L	L	M	-	-	-
CO4	M	M	M	M	S	-	M	-	-	L	L	M	-	-	-
CO5	M	M	M	M	S	-	M	-	M	L	L	M	-	-	-
S- Strong; M-Medium; L-Low															

SYLLABUS

THEORY

BASIC CIRCUIT CONCEPTS:

DC and AC circuits - R, L, and C elements phasor diagrams-impedance, admittance - real and reactive power-power factor. 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 theorem – Thevenin's theorem – Norton's theorem.

RESONANCE AND COUPLED CIRCUITS:

Series and parallel resonance – Bandwidth and Q factor. Inductively coupled circuits – self and mutual inductance - co-efficient of coupling - Dot convention.

TRANSIENT ANALYSIS:

Transient response – natural and forced response. Transients in RC, RL and RLC circuit with DC and sinusoidal excitation.

THREE PHASE POWER MEASUREMENT

Analysis of three phase three wire and four 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 methods.

PRACTICAL

Verification of the thevenin's, norton's, super position, reciprocity and maximum power transfer theorem. Tme domian analysis of RL and RC transient circuits. Series and Parallel resonance circuits. Three phase power measurement circuit by two wattmeter method.

Text Book

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.

Reference Books

1. Prof.T.NageswaraRao,"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, 5 th Edition, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. B. Parvathi Sangeetha	Assistant Professor	EEE	parvathi.eee@avit.ac.in
2	Mr. P. Loganathan	AP	EEE/VMKVEC	loganathan@vmkvec.edu.in

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

Basics of Electrical and Electronics Engineering

COURSE OBJECTIVES

1	To understand the small signal BJT/FET Models.
2	Identify the frequency response of BJT and FET.
3	Apply the basic concept and working of various types of feedback amplifiers and oscillators.
4	To understand the working different types of large signal amplifiers.
5	To learn about various types of tuned amplifiers

COURSE OUTCOMES

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

CO1. Determine various factors for HWR, FWR and construct Clipper, Clamper and voltage regulator circuits	Apply
CO2. Determine the characteristics and parameters of BJT and FET in various configuration	Apply
CO3. Design the voltage divider bias for BJT, FET and justify stability factors.	Apply
CO4. Analyze various parameters of feedback amplifier (voltage series, voltage shunt, current series and current shunt) by using simulation tools.	Analyze
CO5. Analyze the efficiency of large signal amplifiers and bandwidth of tuned amplifier by 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	M	M	-	-	-	-	-	-	-	-	M	M	-	-
CO2	S	M	M	M	-	-	-	-	-	-	-	M	M	-	-
CO3	S	S	M	M	-	-	-	-	-	-	-	M	S	L	L
CO4	S	S	M	M	M	-	-	-	-	-	-	M	S	M	L
CO5	S	M	M	M	M	M	-	-	-	-	-	M	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

SEMICONDUCTOR DIODE AND ITS APPLICATIONS
PN Junction Diode –, Zener Diode- Characteristics -equivalent circuits, Diode current Equation, Light-Emitting Diodes, Half-Wave Rectification, Full-Wave Rectification, Bridge Rectifier, Voltage regulator- Line and Load regulation, Clipper, Clamper, Voltage-Multiplier Circuits,

TRANSISTORS & SPECIAL DEVICES
Transistor: Construction, Transistor Operation and characteristics- CE, CB, CC Configuration -Characteristics of JFETs, Transfer Characteristics, Depletion-Type MOSFET, Enhancement-Type MOSFET. Special Devices: SCR, Shockley Diode, Diac, Triac, Unijunction Transistor, Phototransistors, MISFETs, MESFET.

BIASING CIRCUITS & SMALL SIGNAL ANALYSIS
BJT Biasing : Fixed Bias Configurations, Emitter Bias Configuration, Voltage Divider Bias - AC /DC Load line- Operating Point -, Hybrid Equivalent model, stability factor, Small Signal Analysis of CE Amplifier.
FET Biasing : Fixed bias, Self bias and Voltage divider bias, FET amplifiers – small signal model and Configurations using multisim simulation tool.

FEEDBACK AMPLIFIERS
Concept of feedback – effects of negative feedback- Input impedance- output impedance, voltage gain, current gain, Types of feedback amplifier-Voltage and Current Series, Voltage and Current Shunt, Gain Bandwidth Product.

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 multisim simulation tool.

TEXT BOOKS:
1.Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill,4thEdition, 2015.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11thEdition, 2013

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

COURSE DESIGNERS				
S.No	Name of the Faculty	Designation	Department	Mail ID
1.	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
2.	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in

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: Basics of electrical & electronics engineering.

COURSE OBJECTIVE

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

1	To understand the concepts of field energy, co energy, mechanical force and production of torque and EMF.
	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 OUT COMES

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	Analyse
CO4: Clarify the starter and speed control method of DC Motors Apply	Evaluate
CO5: Illustrate the construction and working of Single Phase and Three Phase Transformers Apply & to Analyze the testing of DC Machines & Transformer	Evaluate

MAPPING WITH PROGRAMME OUTCOME AND PROGRAMME SPECFIC OUTCOMES

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

Principle, construction and operation of single-phase transformers, equivalent circuit, phasordiagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer- construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers – construction principle, applications and comparison with two winding transformer, Magnetizing current effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current Phase conversion - Scott connection, three-phase to six- phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers, Cooling of 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.

TOTAL : 45 PERIODS

TEXT / REFERENCES:
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hil Education, 2013.
2. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
 3. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. 62 4. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
5. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
6. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

COURSE DESIGNERS

S.No	Name of Faculty	Designation	Department	Mail.id
1	A.BALAMURUGAN	Associate .Professor	VMKVEC	balamurugan@vmkvec.edu.in
2				

	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: Electrical Machines – I

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 withdifferent 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

Construction - Armature Winding - Winding Factors - EMF Equation - Armature Reaction - Voltage Regulation - Predetermination of Regulation by Synchronous Impedance, MMF and Potier Methods - Power Flow Equations - Parallel Operations - Synchronization and Synchronizing Power - Synchronizing to Infinite Busbar - Slip Test.

SYNCHRONOUS MOTOR

Construction - Specific loading - output equation - main dimensions(D&L), Principle of Operation - Methods of Starting - Phasor Diagrams - Power Flow Equations - Effect of Varying Field Current and Load - V and Inverted V Curves - Synchronous Condenser - Hunting and Suppression Techniques.

THREE PHASE INDUCTION MOTOR

Construction - Specific loading - output equation - main dimensions (D&L) - Types - Principle of Operation - Equivalent Circuit - Phasor Diagram - Power across Air-gap, Torque and Power Output - Slip -Torque Characteristics - No-Load and Blocked Rotor Tests - Circle Diagram - Cogging and Crawling - Braking - Induction Generators- 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- Servo 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.

COURSE DESIGNERS

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

	ELECTROMAGNETIC THEORY	Category	L	T	P	C
		CC	3	0	0	3

Preamble

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

PREREQUISITE : Engineering Mathematics

COURSE OBJECTIVES

1	To convey the basic physical concepts that lie behind all electrical engineering, the interactions between charged particles, whether stationary or in motion.
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 successful completion of the course, the students will be able to

CO 1	To determine the electric field intensity from the stationary charge distributions and to analyze the electric fields using electromagnetic laws with the associated boundary conditions.	Understand
CO 2	To analyse time varying electric and magnetic fields.	Remember
CO 3	Compare the electric and magnetic boundary conditions, calculate the capacitance and inductance	Remember
CO 4	Summarise the electric magnetic waves and wave propagation in different medium.	Apply
C0 5	Compute Field Modeling & Computation	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	-	-	-	-	L
CO2	M	-	M	-	S	L	M	-	M	L	-	-	-	-	L
CO3	M	-	M	-	S	L	M	-	-	L	-	-	-	-	-
CO4	S	-	S	-	S	M	M	L	-	L	M	-	L	M	-
CO5	S	M	S	S	S	M	S	-	M	L	L	M	-	-	-

S-lv-d-7

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 and its Applications - Potential - Laplace and Poisson's equations -Electrostatic energy –Capacitance- boundary value problems

MAGNETOSTATICS
Current Density - Magnetic field - Magnetic flux - Magnetic flux density - Biot-Savart's law -Ampere's law - Torque – Force – Scalar and Vector Magnetic 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 - Derivation of Wave Equation, Uniform Plane Waves - Conducting media - Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect, Poynting theorem.

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.

TEXTBOOK
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

REFERENCES
1. K. A. Gangadhar, P.M. Ramanathan, Electromagnetic Field Theory, Khanna Publishers,Sixteenth Edition, 2011.   2. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014   3. A.Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	S.Prakash	AP(Gr-II)	EEE/AVIT	sprakash@avit.ac.in
2	Dr. R. Sankarganesh	Associate Professor	EEE/VMKVEC	sankarganesh@vmkvec.edu

		MEASUREMENTS AND INSTRUMENTATION (THEORY AND PRACTICALS)	Category	L	T	P	C
			CC	3	0	2	4

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

PREREQUISITE : Basics of Electrical and Electronics Engineering

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 train the students in the measurement of displacement, resistance, inductance, torque and angle

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

INTRODUCTION

Functional elements of an instrument - static and dynamic characteristics – errors in measurement - statistical evaluation of measurement data - standard and calibration

ELECTRICAL AND ELECTRONICS INSTRUMENTS

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.

COMPARISON METHODS OF MEASUREMENTS

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

STORAGE AND DISPLAY DEVICES

Magnetic disc and tape recorders – digital plotters and printers – CRT displays – digital CRO – LED, LCD and Dot matrix displays. Data Logger

TRANSDUCERS

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.

PRACTICE

Experiment on Transducer & AC Bridges, Calibration of Current Transformer, Instrumentation amplifiers, Calibration of Single phase Energy meter.

TEXTBOOK

1. A.K. Sawhney, Puneet Sawhney, 'A Course In Electrical And Electronic Measurements And Instrumentation ', Dhanpat Rai and Co,2012.
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 2017.

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.

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	S. Jensie Anita			jensiepresley@avit.ac.in

| 2 | Mr. P. Loganathan | AP | EEE/VMKVEC | loganathan@vmkvec.edu.in |

ANALOG AND DIGITAL CIRCUITS	Category	L	T	P	Credit
(Theory and Practicals)	CC	3	0	2	4

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

Semiconductor Devices And Circuits

COURSE OBJECTIVES

1	To understand the small signal BJT/FET Models
2	To learn about various compound configurations of multivibrators
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 various sequential logic circuits

COURSE OUTCOMES

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

CO1. Apply the basic concept and working of various types offeedback amplifiers and oscillators.	Apply
CO2. Design different multivibrators & compound Configurations Circuits.	Apply
CO3. Apply the principles of Boolean algebra to manipulate and minimize logicexpressions	Apply
CO4. Design various combinational logic circuits (adder, subtractor, multiplexer and coders, etc.,)	Analyze
CO5.Design various sequential circuits using flip flops (counters, shift registers, etc.,)	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	-	-
CO2	S	M	M	M	-	-	-	-	-	-	-	M	M	L	-
CO3	S	M	M	M	M	-	-	-	-	-	-	M	S	M	-
CO4	S	S	M	M	-	-	-	-	-	-	-	M	S	M	-
CO5	S	S	M	S	-	-	-	-	-	-	-	M	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

OSCILLATOR CIRCUITS
Concept of feedback – effects of negative feedback-Barkhausen Criterion – Oscillator Circuits: Oscillator Principles – LC oscillators – Hartley oscillator, Colpitts Oscillator, Clapp Oscillator, RC Phase shift oscillators, Sweep oscillator-Wein Bridge Oscillator-Crystal oscillators - Demonstration With Relevant Experiments

COMPOUND CONFIGURATIONS AND MULTIVIBRATORS
Introduction, Cascade Connection, Cascode Connection, Darlington Connection, Differential Amplifier Circuit, CMRR, Schmitt Trigger. Multivirators- Astable –bistable – Monostable-- Demonstration With Relevant Experiments

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 Kmaps, Product of Sums (POS) & Sum of Products (SOP) simplification, don't care conditions, NAND & NOR implementations, Exclusive-OR Function, Hardware Description Language(HDL)- - Demonstration With Relevant Experiments

COMBINATIONAL LOGIC
Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder,
Subtractor, Decimal Adder, Binary Multiplier, Magnitude Comparator, Code Converters, Encoders, Decoders, Multiplexers-- Demonstration With Relevant Experiments

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-- Demonstration With Relevant Experiments

Text Books:
1. Jacob Millman, Christos C Halkias, Satyabrata Jit, "Electron Devices and Circuits", Tata McGraw Hill,4thEdition, 2015.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 11thEdition, 2013
3. Morris Mano, "Digital Design (with an introduction to the verilog HDL)", Prentice-Hall of India.
4. John F. Wakerly, "Digital Design Principles & Practices", 4th edition, Prentice-Hall,2005.

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 De..., 2011. Stephen D. Brown, and Zvonko Vranesic, "Fundamentals of Digital Logi...McGraw Hill, June, 2007.

	4. William Kleitz, "Digital Electronics: A Practical Approach with VHDL", Ninth Edition, Pearson, 2002.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
2.	Dr.R.Ramani	Assistant Professor	ECE	ramani@vmkvec.edu.in

	POWER ELECTRONICSAND DRIVES (THEORY & PRACTICALS)	Category	L	T	P
		CC	3	0	2

PREAMBLE

Power electronics involves the study of electronic circuits intended to control the flow ofelectrical energy. It de processing and control of 'raw' electrical power from anelectrical source such as an AC mains supply, a bat photovoltaic array, or a windturbine into a form and quality suitable for a particular electrical load. It is an enablin with a very wide range of applications.Electric Drives, both ac and dc types, come in many shapes and arestandardized versions for general-purpose applications. Others are intended for specifictasks. In any case, moto selected to satisfy the dynamic requirements of themachines on which they are applied without exceeding temperature.To acquire the practical knowledge in power electronic devices and converters.

PREREQUISITE: SemiconductorDevices and Circuits

COURSEOBJECTIVES

1	Togetanoverviewofdifferenttypesofpowersemiconductordevices andtheirswitchingcharacteristics.
2	Tounderstandtheoperation,characteristics andperformanceparameters ofcontrolledrectifiers.
3	Tostudytheoperation,switchingtechniquesandbasics topologiesofDC-DCswitchingregulators.
4	TostudytheoperationofACvoltagecontroller and tolearn thedifferentmodulationtechniquesinverters.
5	Toemploythe solidstatespeedcontroltechniquesforDCdrivesforefficientcontrol.
6	Toemploysolidstatespeedcontroltechniquesfor ACdrivesforproficientandlosslesscontrol.
7	To Analyze the performance of semiconductor devices and converters through experiments.

COURSEOUTCOMES

Onthesuccessful completionofthecourse,studentswillbe ableto

CO1:Define semiconductorphysicstothepropertiesofrealpowersemiconductordevicesanddifferentiatefromlowpowerdevices.	Re
CO2: Implement rectifiers and inverters forthe given application	
CO3: Implement DC-DC converters andAC-AC converter for the givenapplication	
CO4: Interpret theconceptsofanelectricaldrivesystemandchoosea suitablemotordrive fordifferentapplications&Explain the basics and advantages ofelectric drives.	Ur
CO5: Appraise the conventional speed control methods of AC motors withstartingandbrakingmethods.	Ana
CO6:ValidatetheproficientcontrolofACandDCdrivesbyutilizethepowerelectronicsconcepts.	Eva
C07: Analyze the performance of semiconductor devices and converters by conducting suitable experiments.	A

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMME SPECIFICOUTCOMES

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

CO6	S	S	S	S	S	M	M	-	M	M	S	M	L	S
C07	S	M	L	L	M	-	-	-	S	-	M	-	-	S

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

SYLLABUS

POWERSEMI-CONDUCTOR DEVICES
Overviewofswitchingdevices - Principles of operation, Characteristics, Protection and Gate dri
ofPowerDiode,PowerTransistor,MOSFET,IGBT,SCR andTRIAC - Design of filters.

RECTIFIERS& CHOPPERS
Singlephaseandthreephase rectifiers - Dualconverters.BasicPrinciplesofChoppers-Stepdownandstepupchopper–
Timeratiocontrolandcurrentlimitcontrol–Buck,Boost,Buck-Boostconverters.

INVERTERS &AC-ACCONVERTERS
Singlephaseandthreephase[120º&180º mode] Voltage Sourceinverters–Current SourceInverters - Regeneration i
- PWMtechniques–SinglephaseandthreephaseACvoltagecontrollers –singlephaseandthreephasecycloconv
Cycloconverter Control Scheme.

ELECTRICALDRIVES
General electric drive system - Classification and TypesofElectricalDrives –Factorsinfluencingtheselection
drives– Torque-speed characteristics of motors- heating andcoolingcurves–classesofduty–Selection of motor p
simpleproblems.

SOLIDSTATEDRIVES
Advantagesofsolidstatedrives–Speed control methods of DCmotorsusingrectifiersandchoppers– Speed
controlofinductionmotorbyStator Voltage control, Voltage / Frequency control -Slippowerrecoverysystems.

PRACTICE

CharacteristicsofSCR, MOSFET andIGBT. ConverterfedDC MotorDrive.InverterfedInductionMotorDri

TEXTBOOKS:
1. RashidM.H.,"PowerElectronicsCircuits,Devices andApplications",PrenticeHallIndia,3rdEdition,NewDelhi,200
2. G.K.Dubey"FundamentalElectricalDrives"secondedition2002,NarosaPublications,Second edition,2002.

REFERENCES:
1. Cyril.W.Lander,"PowerElectronics",McGraw HillInternational,ThirdEdition,1993.
2. P.S.Bimbra"PowerElectronics",KhannaPublishers,thirdEdition2003.
3. PhilipT.Krein, "ElementsofPowerElectronics"OxfordUniversityPress,2004Edition.
4. N.K.De.,P.K.Sen"ElectricDrives",PrenticeHall,Firstedition1999.
5. Pillai,S.K.,"A FirstcourseonElectricalDrives",WileyEasternLtd.,New Delhi, 1982

COURSEDESIGNERS

S.No.	Nameof theFaculty	Designation	Department	MailID
1	Dr. R. Sankarganesh	AssociateProfessor	EEE/VMKVEC	sankarganesh@vmkv
2	Mr.N.P.Gopinath	Assistant Professor(Gr-II)	EEE/AVIT	Gopinathnp@avit.ac.i

	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

PREREQUISITE: ELECTRO MAGNETIC THEORY

COURSE OBJECTIVES

1	To study the structure of electric power system and to develop expressions for the computation of transmission
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	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

φ-l.-d-=7

SYLLABUS

TRANSMISSION LINE PARAMETERS

Structure of electrical power system: 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, Simple diagrams of typical towers and conductors for 400, 220 and 110 kV operations

MODELLING AND PERFORMANCE OF TRANSMISSION LINES

Classification of lines: Short line, medium line and long line - equivalent circuits, attenuation constant and 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 insulators – material for insulators – types of insulators – failure and 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

SUBSTATION , GROUNDING SYSTEM AND DISTRIBUTION SYSTEM

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   earthing in a substation. Qualitative treatment to neutral grounding and earthing 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,

High voltage DC transmission – HVDC projects in INDIA and abroad – advantages and disadvantages of HVDC transmission – basics of protection of HVDC system.
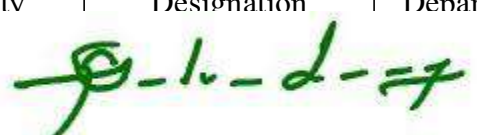
TEXTBOOK

1. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2005.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2004.
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.

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	Jensie Anita S		E	jensiepresley@avit.ac.in

	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

      Differential Equations and Transforms

COURSE OBJECTIVES

1	Understand the feedback and feed-forward control; apply 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 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 – classifications of control systems – Mechanical Translational and Mechanical 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, 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, Guidelines for sketching root locus , Nyquist stability criterion. Cascade Lag compensation, cascade Lead compensation and cascade Lag-Lead compensation

STATE VARIABLE ANALYSIS, AND APPLICATION OF CONTROL SYSTEMS

Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, Equivalence between transfer function and state variable representations, Digital control design using state feedback. Synchros – AC servomotors- DC Servo motors.

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.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-mail id
1	D.SARANYA	Assistant Professor (Gr-II)	EEE / AVIT	dsaranya@avit.ac.in
2	R. SATHISH	Assistant Professor	EEE/VMKVEC	sathish@vmkvec.edu.in

	POWERSYSTEMANALYSIS	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: Transmissions and Distributions

COURSEOBJECTIVES

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 behavior of power system when it is subjected to a fault.
5	TothestudytheImportanceofstabilityanalysisinpowersystemplanningandoperation.

COURSEOUTCOMES

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

CO1:Describe the modeling 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

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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
Need 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.

POWERFLOWANALYSIS
Importance of power flow analysis in planning and operation of power systems -statement of power flow problem - classification of buses- development of power flow model in complex variables form and polar variables form- iterative solution using Gauss-Seidel method -Q-limit check for voltage controlled buses – algorithm and flow chart-iterative solution using Newton-Raphson method – algorithm and flow chart.

FAULTANALYSIS–BALANCED FAULTS
Importance of short circuit analysis - assumptions in fault analysis-analysis using Thevenin's theorem-Z-bus building algorithm- fault analysis using Z-bus – algorithm and flow chart- computations of short circuit capacity, post fault voltage and currents.

FAULT ANALYSIS–UNBALANCEDFAULTS

Introduction to symmetrical components – sequence impedances – sequence circuits of synchronous machine- 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 flowchart.

STABILITYANALYSIS
Importance of stability analysis in power system planning and operation – classification of power system stability - angle and voltage stability- Single Machine Infinite Bus(SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time –solution of swing equation by modifiedEulermethodandRunge-Kuttasecondordermethod.Algorithmandflowchart.

TEXT BOOKS
1. HadiSaadat,'Power System Analysis',TataMcGrawHill PublishingCompany,NewDelhi,2002.
2. Olle. I. Elgerd, 'Electric Energy Systems Theory – An Introduction', Tata McGraw Hill Publishing Company Limited, New Delhi,SecondEdition, 2003.

REFERENCES
1. P.Kundur,'PowerSystem StabilityandControl,TataMcGrawHill,Publications,1994.
2. JohnJ.Grainger andW.D.Stevenson Jr., 'Power System Analysis', McGrawHillInternationalBookCompany,1994.
3. I.J.Nagrath and D.P.Kothari, 'Modern Power System Analysis', TataMcGraw-HillPublishingCompany, NewDelhi,1990.
4. .K.NagasarkarandM.S.SukhijaOxfordUniversityPress,2007

COURSEDESIGNERS				
S.No.	NameoftheFaculty	Designation	Department	MailID
1	Dr.V.MANJULA	AssistantProfessor	EEE/VMKVEC	manjula@vmkvec.edu.in
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	MICROCONTROLLER BASED SYSTEM DESIGN & EMBEDDED SYSTEM DESIGN (Theory & Practicals)	Category	L	T	P	Credit
		CC	3	0	2	4

PREAMBLE

Embedded systems course is continuous of the Microprocessor and Microcontrollers, is intended to Design, Implementation and Test of embedded applications. This includes system requirements specifications, architectural and detailed design, and implementation, focusing on real-time applications. Learning the concepts will be enforced by a Project to design and develop an embedded system based on a single-chip microcontroller and to know complete Operating Systems, RTOS

PREREQUISITE : Analog and Digital Circuits

COURSE OBJECTIVES

1	Explore the fundamentals of microcontroller based system design
2	Organize the Arm Processor Embedded Firmware
3	Acquire knowledge of I/O and RTOS role on microcontroller
4	Perform various tasks in designing the Embedded System Design in RTOS
5	Handle the development and debugging tools in Embedded Systems

COURSE OUTCOMES

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

CO1. Explain fundamentals of microcontroller based system design	Understand
CO2. Discuss the Arm Processor Embedded Firmware	Understand
CO3. Illustrate the I/O and RTOS role on microcontroller	Analyze
CO4. Examine the tasks in designing the Embedded System Design in RTOS	Analyze
CO5. Develop and debug tools in Embedded 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	S	M	-	M	-	-	-	-	-	-	-	S	M	-
CO2	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO3	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO4	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-
CO5	S	S	M	-	M	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

Syllabus

REVIEW OF 8051&TYPICAL EMBEDDED SYSTEM
Introduction to Embedded System. Architecture, 8051- CPU Block diagram, MemoryOrganization, Program memory, Data Memory, Interrupts Peripherals: Timers, Serial Port,I/O Port Programming: Addressing Modes, Instruction Set, Programming Timing Analysis Casestudy with reference to 8-bit 8051 Microcontroller.
Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces & Experiments

ARM PROCESSOR ORGANIZATION&EMBEDDED FIRMWARE
ARM9 Microcontroller Architecture-Block Diagram, Features, Memory Mapping MemoryController (MC)-External Bus Interface (EBI)-External Memory Interface-Interrupt Controller-System Timer (ST- Real Time Clock (RTC) Parallel Input/output Controller (PIO)Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, RealTime Clock, Watchdog Timer, Embedded Firmware Design Approaches and DevelopmentLanguages.

RTOS BASED EMBEDDED SYSTEM DESIGN
Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multi-tasking, Task Scheduling.

TASK COMMUNICATION
Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

DEVELOPMENT & DEBUGGING TOOLS FOR MICROCONTROLLER BASED EMBEDDED SYSTEMS
Software and Hardware tools like Cross Assembler, Compiler, Debugger, Simulator, In-Circuit Emulator (ICE), Logic Analyser & Experiments

Text Books:
1. Intel Hand Book on "Embedded Microcontrollers", 1st Edition
2. Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, "The 8051Microcontroller and Embedded Systems using Assembly and C", 2e, PHI
3. ARM Company Ltd. "ARM Architecture Reference Manual– ARM DDI 0100E"
4. David Seal "ARM Architecture Reference Manual", 2001 Addison Wesley, England; Morgan Kaufmann Publishers
5. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide -Designing and Optimizing System Software", 2006, Elsevier
6. Ayala, Kenneth J "8051 Microcontroller - Architecture, Programming &Applications", 1st Edition, Penram International Publishing

COURSE DESIGNERS				
S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Muthumanickam	Professor	ECE	muthumanickam@vmkvec.edu.in
2	Dr.T.Sheela	Associate Professor	ECE	sheela@vmkvec.edu.in

	POWER SYSTEM PROTECTION AND SWITCHGEAR	Category	L	T	P	Cred
		CC	3	0	0	3

PREAMBLE

The course aims to impart fundamental knowledge on various abnormal operating conditions in power system anddescribe the apparatus and system protection schemes, phenomena of current interruption and various switchgears.

PREREQUISITE – Electrical Machines-I and Electrical Machines-II

COURSE OBJECTIVES

1	To study about the Causesofabnormaloperatingconditions(faults,lightningand switchingsurges)of theapparatusandsystem.
2	To analyze the Characteristicsandfunctions ofrelays andprotection schemes.
3	To study about the Apparatusprotection,staticandnumericalrelays.
4	To realize the Functioningofcircuitbreaker.

COURSE OUTCOMES

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

CO1: findthecausesofabnormaloperating conditionsof theapparatusand system.	Apply
CO2: understandandanalyzethe Electromagnetic and StaticRelays.	Analyze
CO3: recommendthesuitable protection scheme for electrical apparatus.	Apply
CO4: studyaboutthestatic and numericalrelays.	Understand
CO5: suggestsuitabilitycircuitbreaker.	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	S	M	S	L	-	-	-	-	L	S	M	-
CO2	S	S	M	S	M	S	L	L	-	-	L	L	S	M	-
CO3	S	M	S	S	M	S	L	-	-	-	-	-	S	M	-
CO4	S	L	L	M	M	S	L	L	-	-	L	L	S	M	-
CO5	S	S	S	S	M	S	L	-	-	-	-	L	S	M	-

SYLLABUS

PROTECTION SCHEMES

Principles and need for protective schemes – nature and causes of faults – types of faults–Methods of Grounding – Zones of protection and essential qualities of protection – Protection scheme.

ELECTROMAGNETIC RELAYS

Operating principles of relays – the Universal relay – Torque equation – R-X diagram – Electromagnetic Relays – Over current, Directional, Distance, Differential, Negative sequence and Under frequency relays.

APPARATUS PROTECTION

Current transformers and Potential transformers and their applications in protection schemes – Protection of transformer, generator, motor, bus bars and transmission line.

STATIC RELAYS AND NUMERICAL PROTECTION

Static relays – Phase, Amplitude Comparators – Synthesis of various relays using Static comparators – Block diagram of Numerical relays – Over current protection, transformer differential protection, distant protection of transmission lines.

CIRCUIT BREAKERS

Physics of arcing phenomenon and arc interruption – DC and AC circuit breaking – re-striking voltage and recovery voltage – rate of rise of recovery voltage – resistance switching – current chopping – interruption of capacitive current – Types of circuit breakers – air blast, air break, oil, SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers – Rating and selection of Circuit breakers.

TEXT BOOKS:
1. SunilS.Rao,'Switchgearand Protection', KhannaPublishers,NewDelhi,2008.
2. B.RabindranathandN.Chander,'PowerSystemProtectionandSwitchgear',NewAgeInternational(P)Ltd.,FirstEdition 2011.
3. ArunIngole,'SwitchGear andProtection'PearsonEducation,2017.

REFERENCE BOOKS:

1. BadriRam,B.H.Vishwakarma,'PowerSystemProtectionandSwitchgear',NewAgeInternationalPvt LtdPublishers,SecondEdition2011.
2. Y.G.PaithankarandS.R.Bhide,'Fundamentalsofpowersystemprotection',SecondEdition,Prentice Hall ofIndiaPvt.Ltd.,NewDelhi,2010.
3. C.L.Wadhwa, 'ElectricalPowerSystems', 6thEdition, NewAgeInternational(P)Ltd.,2010
4. RavindraP.Singh,'SwitchgearandPowerSystemProtection',PHILearningPrivateLtd.,NewDelhi, 2009.
5. VKMetha,"PrinciplesofPowerSystems"S.Chand, 2005.

6. BhaveshBhalja,R.P.Maheshwari,NileshG.Chotani,'ProtectionandSwitchgear'OxfordUniversityPress ,2011.

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	sathsih@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

	EHV AC &DC POWER TRANSMISSION	Category	L	T	P	Credit
		CC	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 :NIL

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 study 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	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

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.

TEXTBOOK
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.

REFERENCES
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

Sl No	Name of the Faculty	Designation	Department	M
1	JENSIE ANITA S	Assistant Professor	EEE/AVIT	jensiepresley@avit.ac.in
2	V.MANJULA	Assistant Professor	EEE/VMKVEC	manjula@vmkvec.edu.in

	PHOTOVOLTAIC ENERGY CONVERSION	Category	L	T	P	Credit
		CC	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	M	L	-	L	S	-	S	M	S	-	S	S	L	M	S
CO2	S	M	L	-	S	S	L	-	S	S	-	S	S	L	S
CO3	M	L	S	-	-	-	-	S	-	-	S	-	-	M	-
CO4	S	M	L		-	-	-	L	-	S	-	-	-	S	L
CO5	-	S	M	L	-	-	L	-	-	-	-	-	S	S	L

S- Strong; M-Medium; L-Low

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

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
1.	Dr. R. Devarajan	Professor	EEE/VMKVEC	devarajan@vmkvec.edu.in
2	Mr.S.Prakash	AP(Gr-II)	EEE/AVIT	sprakash@avit.ac.in

	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.

PREREQUISITE

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 and test with simulation tools	Apply
CO3. Determine the frequency of Feedback amplifiers and test with simulation tools	Apply
CO4. Classify the waveforms of Wave shaping circuits & Feedback amplifiers circuits and test with simulation tools	Analyze
CO5.Determine 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	-	-	-	-	-	-	-	-	L	M	-	-
CO2	S	M	M	M	M-	-	-	-	L	-	L	L	M	-	-
CO3	S	S	M	M	M	-	-	-	L	-	L	L	S	L	L
CO4	S	S	M	M	M	-	-	-	L	-	L	L	S	M	L
CO5	S	M	M	M	-	-	-	-	L	-	-	L	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS
1. Plot the input and output characteristics of a BJT Configuration and to compute the h – parameters
a)Common Emitter, b) Common Base
2. Obtain the Drain characteristics and Transfer characteristics & find the Trans-conductance, Drain resistance and Amplification factor of JFET.
3. Simulation & Hardware realization of Half wave & Full wave Rectifier with, without Filter and determine the efficiency
4. Simulation & Hardware realization of Clipping & Clamping circuits for given reference Voltage levels.
5. Simulation & Hardware realization of Voltage Series Feedback amplifiers and its frequency analysis
6. Design and simulation of Power amplifiers and calculate the efficiency
7. Design and obtain frequency Response the characterization of Single Tuned amplifierCircuit.
8. Construct series voltage regulator and obtain load and line regulation characteristics
9. Construct shunt voltage regulator and obtain load and line regulation characteristics
10. Mini project.

COURSE DESIGNERS

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1	Mr.S.Selvaraju	Associate Professor	ECE	selvaraju@vmkvec.edu.in
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	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 : Nil

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	Understand
CO 2: Compute the efficiency and regulation of a single-phase transformer. Analyze	Understand
CO 3: Testing of Transformer for Modelling Evaluate	Understand
CO4: Testing of a DC Machine and to monitor the efficiency. Evaluate	Analyse
CO 5: Explain the Transformer connections	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	POS2	POS3
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	L	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

SNO	NAME OF THE FACULTY	DESIGNATION	DEPARTMENT	Mail.id
1	A.BALAMURUGAN	ASSOCIATE –PROFESOR	VMKVEC	balamurugan@vmkvec.edu.in
2				

	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 specific 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	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 Servo motor , PMDC & PMAC motor, Linear induction motor and Synchronous Induction motor.

COURSE DESIGNERS

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

	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. Characteristics of Synchronous transmitter and Receiver.

6. Transfer function of Ward – Leonard method of speed control of DC motor.

7. Study of P, PI and PID Controllers (First Order).

8. Simulate DC Position Control system and obtain its step response

9. Analog and simulation of type – 0 and type – 1 systems

10. Stability analysis of Linear Systems

11. Simulation of first order systems using MATLAB/ SCILAB

12. Simulation of second order systems using MATLAB/ SCILAB

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.	D.SARANYA	Assistant Professor GR-II	EEE / AVIT	dsaranya@avit.ac.in

	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

COURSEOBJECTIVES

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 Economic Dispatch and State estimation.
5	To acquire experience in the usage of standard packages for the following analysis/simulation/control functions

COURSEOUTCOMES

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

CO1:Explainthepowersystemplanningandoperationalstudies	Understand
CO2:Explaintheprocedure of bus admittance and impedance matrices and network solutions.	Understand
CO3:Solve the Power flow problems using GS and NR method.	Analyze
CO4:Detect Symmetrical and Unsymmetrical fault.	Analyze
CO5:Describe the Economic dispatch and State estimation.	Understand
CO6:DesigntheElectromagnetictransientcircuits.	Create

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

LISTOFEXPERIMENTS

1.   Computation of Parameters and Modeling of Transmission Lines.

2.   Formation of Network Matrices and Solution of Networks.

3.   Power Flow Analysis Using Gauss-Seidel Method.

4.   Power Flow Analysis Using Newton-Raphson Method.

5.   Symmetric and unsymmetrical fault analysis.

6.   Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.

7.   Load-Frequency Dynamics of Single and Two-Area Power Systems.

8.   State estimation: Weighted least square estimation.

9.   Economic Dispatch in Power Systems.

10.   Electromagnetic Transients in Power Systems.

REFERENCEBOOKS
1.   Laboratoryreferencemanual.

OURSEDESIGNERS

No.	NameoftheFaculty	Designation	Department	MailID
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	HIGH VOLTAGE ENGINEERING	Category	L	T	P	Credit
		EC –PS	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	S	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS AND INSULATION COORDINATION

High Voltage classification - Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – protection against over voltages - 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 – Case Studies.

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.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
1	P. LOGANATHAN	Assistant Professor	EEE / VMKVEC	loganathan@vmkvec.edu.in
2	R. SATHISH	Assistant Professor	EEE / VMKVEC	sathish@vmkvec.edu.in

	POWERSYSTEMOPERATIONANDCONTROL	Category	L	T	P	Credit
		EC –PS	3	0	0	3

PREAMBLE

To become familiar with the preparatory work necessary form 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:Nil

COURSEOBJECTIVES

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.

COURSEOUTCOMES

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

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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 - diversityfactor.Importanceofloadforecastingandsimpletechniquesofforecasting.Anoverviewofpowersystemoperationandcontrolandtheroleofcomputersintheimplementation.(Qualitativetreatmentwithblockdiagram).

REALPOWER-FREQUENCYCONTROL

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.

REACTIVEPOWER–VOLTAGECONTROL

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 – tap changing 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.

COMMITMENTANDECONOMICDISPATCH

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.

COMPUTERCONTROLOFPOWERSYSTEMS

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.WoodandBruce F.Wollenberg,'PowerGeneration,OperationandControl',JohnWiley& Sons,Inc., 2003.
2. Chakrabarti&Halder,"PowerSystemAnalysis:OperationandControl",PrenticeHallofIndia,2004Edition.

REFERENCEBOOKS

1. D.P.KothariandI.J.Nagrath,'ModernPowerSystemAnalysis',ThirdEdition,TataMcGrawHillPublishingCompanyLimited,NewDelhi,2003.(For Chapters1,2&3)
2. L.L. Grigsby,'TheElectric PowerEngineering,HandBook',CRCPress& IEEE Press,2001.
3. HadiSaadat, "PowerSystemAnalysis",(Forthe chapters1,2,3and4)11thReprint2007.
4. P.Kundur,'Power SystemStabilityandControl' MCCrawHillPublisher,USA,1994.
5. Olle.I.Elgerd,'ElectricEnergySystemstheoryanintroduction'TataMcGrawHillPublishingCompanyLtd.NewDelhi,SecondEdition2003.

COURSEDESIGNERS

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

		POWER QUALITY AND FACTS	Category	L	T	P	Credit
			EC- PS	3	0	0	3

PREAMBLE

      This course imparts knowledge about various electrical power quality issues and emphasis the need for PQ monitoring and measurement. To develop the knowledge in the area of FACTS controller using different techniques.

PREREQUISITE: Nil

COURSEOBJECTIVES

1	Describe the various power quality issues.
2	Identify the root cause of power quality problems.
3	Interpret the need for PQ monitoring and measurement.
4	To Study about working principle, Different modes of operation and application soft thyristors controlled series capacitor.
5	To Study the different voltage source converters based FACTS controllers.

COURSEOUTCOMES

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

CO1: Explain the various power quality problems.	Understand
CO2: Discuss the root cause of power quality problems.	Understand
CO3: Discuss the need for PQ monitoring and measurement.	Understand
CO4: Design and modeling of various FACTS Controllers	Create
CO5: Predict the impact of FACTS controllers on AC transmission system.	Analyze

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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	--	--	L	--	--	--	--	M	M	L	--	S	L
CO4	S	M	S	--	--	--	--	--	--	--	--	--	S	S	M
CO5	M	--	--	S	--	M	--	--	--	--	--	--	--	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
Voltagedips,overvoltages,shortsupplyinterruptions,voltagefluctuations and flicker-sources, effects, measurement and mitigation

Transients
Transientsystemmodel,examplesoftransientmodelsandtheirresponse,powersystemtransientmodel,typesandcauses of transients, lightning, other switching transients.

Voltage and Current Unbalance
Symmetricalcomponentsofcurrentsandvoltages,sources,effects,measurementsandmitigation

Solving power quality problems using CPD
Power quality measuring equipment-Smartpowerqualityanalyzers,Introductiontocustompowerdevices(CPD)– STATCOM,DVR,UPQC.

THYRISTOR CONTROLLED SERIES CAPACITOR(TCSC)ANDAPPLICATIONS

Operation of the TCSC – Different modes of operation – Modeling of TCSC – Variable reactance model – Modeling for Power Flow and stability studies. Applications: Improvement ofthesystemstabilitylimit–Enhancementofsystemdamping-SSRMitigation.

VOLTAGESOURCECONVERTERBASEDFACTS 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 –ModelingofSSSCinloadflowandtransientstabilitystudies.Applications:SSRMitigation-UPFCand IPFC.

TEXT BOOKS

1. SankaranC,"PowerQuality",CRCPress specialIndianedition2009.
2. K.R.Padiyar,"FACTSControllersinPowerTransmissionandDistribution",NewAgeInternational(P) Limited, Publishers, New Delhi, January2016.
3. R.MohanMathur,Rajiv K. Varma," Thyristor– Based Facts Controllers for ElectricalTransmissionSystems",IEEEpressandJohnWiley&Sons,January2011.

REFERENCE BOOKS

1. Roger.C.Dugan,MarkF.Mcgranaghan &H.WayneBeaty," Electrical power system Quality" McGraw-HillNewyorkSecondedition2003.
2. Math H.J.Bollen, « Understanding Power Quality Problems : Voltage Sags and Interruptions », IEEE Press, NewYork, 2000.
3. EwaldFuchs MohammadMasoum,"PowerQualityinPowerSystemsandElectricalMachines"2nd Edition, AcademicPress,ISBN:9780128007822,2015.
4. NarainG.Hingorani, "UnderstandingFACTS–ConceptsandTechnologyofFlexibleACTransmissionSystems",StandardPublishersDistributors,NewDelhi,March2011.

COURSE DESIGNERS				
S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.V.MANJULA	Assistant Professor	EEE/VMKVEC	manjula@vmkvec.edu.in
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	SPECIAL ELECTRICAL MACHINES	Category	L	T	P
		EC- PS	3	0	0

PREAMBLE:

This courseaims to impart in students, a good understanding of fundamental ofdifferent types of special machines. Thecourse includes constructional details, operating motorcharacteristics,microprocessorbasedcontrollers andapplicationsofvarious typesofspecialmachines.

PREREQUISITE:Nil

COURSEOBJECTIVES

1	Tounderstandtheconstruction,principleofoperation,torqueequation,drivercircuits&applicationsof Synchronousreluctancemotors.
2	Tostudytheconstruction,principleofoperation,torqueequation,drivercircuits&applicationsof Steppermotors.
3	Tounderstandtheconstruction,principleofoperation,torqueequation,drivercircuits&applicationsof Switchedreluctancemotors.
4	Tostudytheconstruction,principleofoperation,torqueequation,drivercircuits&applicationsof Permanentmagnetsynchronousmotors.
5	Tounderstandtheconstruction,principleofoperation,torqueequation,drivercircuits&applicationsof PermanentmagnetbrushlessDCmotors.

COURSEOUTCOMES

On the successfulcompletionofthecourse,studentswillbeable to

CO1:InterpretthebasicconstructionandoperatingprincipleofSynchronousReluctanceMotor, SRM,Steppermotor,PMSM andPMBLDCMotor | Un

CO2:Predict themotorcharacteristics,powerinputandtorquedevelopmentinSynchronousReluctance Motor,SRM,Steppermotor,PMSM andPMBLDCMotor. | Un

CO3:Illustrate thedrivesystemsandcontrolschemesforSteppermotors,SRM,PMSMandPMBLDCMotor. | A

CO4:Determinethe suitablespecialpurposemotorforthe specific application | A

CO5:ExaminetheMicroprocessorbasedcontrolofSteppermotors,SRM,PMSMandPMBLDCMotor. | A

CO6: Summarize permanent magnet materials and magnetic characteristics. | Un

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO
CO1	M	L	-	-	-	-	-	-	-	-	M	-	-	-
CO2	M	L	-	L	-	-	-	-	-	-	M	-	-	L
CO3	S	M	M	M	M	-	L	-	M	L	S	-	-	S
CO4	S	M	M	L	-	-	-	-	-	-	M	L	-	M
CO5	M	L	-	M	S	-	L	-	M	-	S	L	-	S
C06	S	-	M	L	-	-	L	-	-	-	M	L	M	-

S-Strong;M-Medium;L-Low

SYLLABUS

SynchronousReluctanceMotors

Constructional features - Operating principles - Types - Axial and Radial flux motors - Reluctance torque-Torque equation-characteristics-Syncreldrivesystem-Phasordiagram-Applications.

Steppermotors

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 loopcontrol-Microprocessorcontrolofsteppingmotors-Applications.

SwitchedReluctanceMotors

Constructional features - Principle of operation - Rotary andLinear SRMs - Torque equation- Modes ofoperation-Powerconvertercircuits-ClosedloopcontrolofSRMdrive-Microprocessorcontrolof SRMdrive -Sensorless controlofSRM drive-Characteristics-Applications.

PermanentMagnetBrushless DCMotors

Permanent magnet materials - Magnetic characteristics - Comparison between PMBLDC motor and Conventional DC motor - Constructionalfeatures-Principleofoperation– Classifications– Rotor position sensors - EMFandtorqueequations- - Controller for PMBLDC motor - - Mechanical and Electronic commutators - -Torque-speedcharacteristics-Magneticcircuitanalysis-SensorlesscontrolofBLDC motors-Applications.

PermanentMagnetSynchronous Motors

Evolution of Synchronous Motor - Constructionalfeatures- Principleof operation- EMFandTorqueequations-Armaturereaction EMF-Sinewavemotorwithpracticalwindings-Phasordiagram-Torque/speedcharacteristics - Power controllers - Comparison of Permanent magnet excitation and Electromagnetic excitation - Microprocessor based control ofPMSM -Applications.

TEXTBOOKS:
1. BimalK.Bose,"ModernPowerElectronics andACDrives",PrenticeHall,NewDelhi,2005.
2. Gopal K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House Pvt.Ltd.,New Delhi, Secondedition,2015.

REFERENCEBOOKS:
1. R.Krishnan,PermanentMagnetSynchronousandBrushlessDC MotorDrives,PrenticeHallofIndia,2009.
2. T.J.E.Miller,"BrushlessPermanentMagnetandReluctanceDCMotorDrives",ClarendonOxfordPress,1989.
3. T.Kenjo,"SteppingMotorsandtheirMicroprocessorControls",ClarendonOxfordPress,1994.
4. K.Venkataratnam,"SpecialElectricalMachines",UniversityPress(India)Pvt.Ltd.,2009.
5. E. G. Janardanan, "Special Electrical Machines", PHI Learning Private Limited, ISBN: 978-81-203-4880-6,Delhi,2014.

COURSEDESIGNERS

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Dr. R.Sankarganesh	AssociateProfessor	EEE/VMKVEC	sankarganesh@vmkvec.edu.in
2	Dr.K.Boopathy	Professor	EEE/AVIT	boopathyk@avit.ac.in

	WIND ENERGY CONVERSION SYSTEMS	CATEGORY	L	T	P	C
		EC- PS	3	0	0	3

PREAMBLE

To understand and familiarize the principle ,concepts of wind energy conversion systems.

PREREQUUISITE :Nil

COURSE OBJECTIVE

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 convention
4.	To study about the variable speed systems in wind energy convention
5.	To introduction the grid connected control and monitoring sytems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to	Understand
CO1: Realize the basics of wind energy conversion systems	Understand
CO2:Comprehend various types of wind turbines in energy conversion systems	Analysis
CO3:understand the operations of various types of electrical machineries used for fixed speed systems.	Analysis
CO4:Illustrate the generation of electrical power from Variable speed system.	Analysis
CO5:Acquire knowledge on grid connected wind farm and 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	M	-	-	L	-	M	-	M
CO2	S	S	-	-	M	S	S	M	-	-	L	-	L	-	L
CO3	S	S	L	-	S	S	S	M	-	-	M	-	M	L	L
CO4	S	M	L	M	S	S	M	M	-	-	M	-	M	-	-
CO5	S	M	L	M	S	S	M	L	L	-	M	-	M	-	M

S-STRONG ,M-MEDIUM,L-LOW

SYLLABUS

INTRODUCTION   9

Components of WECS-WECS schemes-Power obtained from wind-simple momentum theory-Power coefficient-Sabinin's theory-Aerodynamics of Wind turbine

WIND TURBINES   9

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   9

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   9

Need of variable speed systems-Power-wind speed characteristics-Variable speed constant frequency systems synchronous generator- DFIG- PMSG -Variable speed generators modeling - Variable speed variable frequency schemes.

GRID CONNECTED CONTROL & MONITORING SYSTEMS   9

Wind interconnection requirements, FACTS control & 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 impact on steady state and dynamic performance of the power system including modeling issue- WECS in various

Total Hours = 45

REFERENCES

1. L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990
2. S.N.Bhadra, D.Kastha,S.Banerjee,"Wind Electrical Sytems",Oxford University Press,2010.
3. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
4. E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd.,Trowbridge,1976.
5. N. Jenkins," Wind Energy Technology" John Wiley & Sons,1997
6. S.Heir "Grid Integration of WECS", Wiley 1998.

COURSE DESIGNERS

S.No	Name of the faculty	Designation	Department	Mail-id
1	Mr.A.BALAMURUGAN	ASSOCIATE PROFESSOR	EEE	balamurugan@vmkvec.edu.in

	ELECTRIC VEHICLES	Category	L	T	P	Credit
		EC- PS	3	0	0	3

PREAMBLE

This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric vehicles.

PREREQUISITE: 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	-	-	-	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	-	-	-	-	-	-	-

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. Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

HYBRID ELECTRIC VEHICLES

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

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

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. R. Devarajan	Professor	EEE	devarajan@vmkvec.edu.in
2	Mr. V.Rattankumar	Assistant Professor	EEE	rattankumar@avit.ac.in

	DISTRIBUTED GENERATION AND MICROGRIDS	Category	L	T	P	C
		EC- PS	3	0	0	3

Preamble

To introduce the fundamentals of Distributed Generation and Implementation in Microgrid.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	To illustrate the concept of distributed generation
2	To analyze the impact of grid integration
3	To study concept of Microgrid and its configuration

COURSE OUTCOMES

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

CO 1	Study the need for DG's and various types	Understand
CO 2	Understand the concepts and impacts in Grid Intergration	Understand
CO 3	Understanding of the microgrid types and configurations	Understand
CO 4	Analyze the various types of control in micro grid in islanded and grid connected operation	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	L	-		S	S	-		L	-	-	-	-	M
CO2	M	-	M	-	S	L	M	-	M	L	-	-	-	-	-
CO3	M	-	M	-	S	L	M	-		L	-	-	L	M	-
CO4	S	-	S	-	S	M	M	L	-	L	M	-	-	-	L
CO5	S	M	S	S	S	M	S	-	M	L	L	M	-	L	-

SYLLABUS

UNIT - I	INTRODUCTION	9
Conventional power generation: advantages and disadvantages, Energy crises, Nonconventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.		
UNIT - II	DISTRIBUTED GENERATIONS (DG)	9

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

UNIT - III	IMPACT OF GRID INTEGRATION	9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT - IV	INTRODUCTION TO MICROGRID	9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids

UNIT - V	CONTROL AND OPERATION OF MICROGRID	9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

TEXTBOOK

1. "Voltage Source Converters in Power Systems: Modeling, Control and Applications", Amirnaser Yezdani, and Reza Iravani, IEEE John Wiley Publications.
2. "Power Switching Converters: Medium and High Power", Dorin Neacsu, CRC Press, Taylor & Francis, 2006.
3. "Solar Photo Voltaics", Chetan Singh Solanki, PHI learning Pvt. Ltd., New Delhi,2009

REFERENCES

1. "Wind Energy Explained, theory design and applications," J.F. Manwell, J.G. McGowan Wiley publication
2. "Biomass Regenerable Energy", D. D. Hall and R. P. Grover, John Wiley, New York, 1987.
3. "Renewable Energy Resources" John Twidell and Tony Weir, Tyalor and Francis Publications, Second edition

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	S.Prakash	AP(Gr-II)	EEE	sprakash@avit.ac.in
2				

	Power Converters Analysis and Design	Category	L	T	P	Credit
		EC- PS	3	0	0	3

PREAMBLE

To Give an Introduction to The Recent Developments in The Power Electronics Converters. This Course Introduces the Advanced Power Converters Such as Isolated Dc-Dc Converter, Reactive Elements. It Also Deals with The Synchronous Rectifiers and Cascaded Boost Converters.

PREREQUISITE
Nil

COURSE OBJECTIVES

1	Acquire a basic understanding of various power converter modules used to build a power electronics system and acquire the ability to select and design suitable circuit.
2	To impart knowledge on the design of different components for Power converter Systems.
3	To learn the switching losses of various triggering techniques
4	To understand the designing concept of various types of chopper and rectifier
5	To impart knowledge on the design of closed-loop compensators for DC-DC Converter

COURSE OUTCOMES

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

1. Select Power Semiconductor Switches for Power Electronic converters and calculate Losses in the Switch.	Remember
2. Apply the need and working of an Isolated DC-DC Converter for real-time application.	Apply
3. Implement the Design Reactive components for Power Electronic Converters.	Analysis
4. Develop a Model the DC-DC Converter Using state Space Technique.	Implement
5. Modelling of Design compensator for DC-DC Converters.	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	S	M	-
CO2	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	M	M	L	L	-	-	-	-	-	-	L	S	M	-
CO5	S	S	M	M	M	-	-	-	-	-	-	L	S	M	M

S- Strong; M-Medium; L-Low

Syllabus

TRIGGERING LOSS CALCULATION

Survey of devices: Diode, Thyristor, BJT, IGBT, MOSFET and TRIAC-Realization of Semiconductor switch for one quadrant operation, Current bidirectional operation, Voltage bidirectional operation,
four quadrant operation- Thermal Design of Power Switching Devices-Estimation of loss in switch: Conduction Loss Switching Loss –Blocking Loss- Transistor Switching with Clamped Inductive Load.

ISOLATED CHOPPER CONVERTER

Need for Isolated Converters-Operation and Derivation of Voltage equation: Forward Converter-Fly back converter Push pull converter-Half Bridge and Full Bridge Converter.

DESIGN OF REACTIVE ELEMENTS IN POWER ELECTRONIC SYSTEMS:
Introduction-Design of Inductor: Material Constraint-Design Relationships-Design Steps-Design of Transformer: Design Equations-Design Steps-Different Types of Capacitors for Power Electronics Applications-Related problems on design of Inductor and Transformer and Evaluation of loss in capacitor

DC-DC CONVERTER DYNAMICS
Small Signal Analysis of Converter-State Space Averaging Technique-Steps involved in state space averagingDerivation of Transfer function of Ideal buck, boost converter using state space averaging- Converter Non Idealities.

COMPENSATOR DESIGN AND CURRENT MODE CONTROL
Closed loop requirements-Compensator structure-Design of compensator-Introduction of Current Mode Control Block diagram of Current Mode Control-Advantages of Current Mode control

TEXT BOOKS:

1. Ned Mohan,Undeland and Robbin, "Power Electronics: converters, Application and design" John Wiley and sons.Inc,New York,2002.

2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, New Delhi, 2010.

COURSE DESIGNERS				
S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.K.Boopathy	Associate Professor	EEE/AVIT	boopathyk@avit.ac.in
2	Dr. R. Devarajan	Professor	EEE/ VMKVEC	devarajan@vmkvec.edu.in
4				

	RENEWABLE ENERGY SOURCES	Category	L	T	P	C
		EC- PS	3	0	0	3

Preamble

To introduce the fundamentals of PV & WIND and other energy sources and utilizing the resources that least pollute the environment.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	Awareness about renewable Energy Sources and technologies.
2	Adequate inputs on a variety of issues in harnessing renewable
3	Recognize current and possible future role of renewable energy sources.

COURSE OUTCOMES

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

CO 1	Develop awareness about renewable energy sources and technologies	Apply
CO 2	Recall to get adequate inputs on a variety of issues in harnessing renewable energy	Remember
CO 3	Match the various renewable energy resources and technologies and their applications	Remember
CO 4	Organize and understand basics about biomass energy	Apply
CO 5	Interview to acquire knowledge about solar energy	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

RENEWABLE ENERGY SOURCES

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources.

WIND ENERGY

Power in the Wind – Types of Wind Power Plants(WPPs)–Components of WPPs-Working of WPPs- Grid integration issues of WPPs.

SOLAR PV AND SOLAR SYSTEM

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants- Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array ,PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, Applications.

BIO MASS ENERGY

Introduction-Bio mass resources –Energy from Bio mass: conversion processes- Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine.

OTHER ENERGY SOURCES

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell :Principle of working- various types – construction and applications. Energy Storage System- Hybrid Energy Systems.

TEXTBOOK

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.

REFERENCES

1. A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011 Arvind Krishnan & Others – Climate Responsive Architecture, Tata Mcgraw – Hill New Delhi 2001.
2. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015
4. Chetan Singh Solanki, " Solar Photovoltaics : Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, 2011.

COURSE DESIGNERS

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1	K.S.Kavitha Kumari	Assistant Professor	EEE	kavitha.eee@avit.ac.in

| 2 | R. SATHISH | Assistant Professor | EEE/VMKVEC | sathish@vmkvec.edu.in |

ENERGY CONVERSION AND STORAGE TECHNOLOGIES	Category	L	T	P	Credit
	EC- PS	3	0	0	3

PREAMBLE

The aim of the course is to understand the basics of energy conservation techniques, energy storages in industries and the associated economical benefits.

PRERQUISITE
NIL

COURSE OBJECTIVES

1	To provide knowledge on the fundamentals of magnetic circuits, energy, force, and torque of single and multi excited systems.
2	To provide knowledge on the transformation of energy from solar and wind.
3	To impart knowledge on Thermal and Solar Photovoltaic systems
4	To understand the concept of Magnetic, Electric, and Chemical Energy Storage systems and their applications
5	To gain knowledge on energy storage in electric.

COURSE OUTCOMES

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

1. Depict the choice and rating of electrical machinery for selected applications	Remember
2. Design and develop a suitable hydrogen storage system to be used along with a fuel cell system.	Apply
3. Implement the chemical energy storage process for real-time application	Implement
4. Analysis and design the battery rating for various application	Analysis
5. Select the best power rating and performance for energy storage 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	M	S	M	-	M	-	-	-	-	-	-	M	S	M	-
CO2	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO3	M	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	M	M	L	L	-	-	-	-	-	-	L	S	M	-
CO5	M	S	M	M	M	-	-	-	-	-	-	L	S	M	M

S- Strong; M-Medium; L-Low

ELECTROMECHANICAL ENERGY ALTERATION

Review of magnetic circuits-Principles of Electromechanical Energy - Conversion, General expression of stored magnetic energy, co-energy and force/torque, example using single and doubly -excited system.

ANALYSIS OF WIND AND PV SYSTEMS

Stand alone operation: Fixed and variable speed wind energy conversion systems (WECS), solar system - Grid connection Issues -Grid integrated SCIG and PMSG based WECS-Grid Integrated solar system.

CHEMICAL ENERGY STORAGE SYSTEMS

Introduction about fuel cells – design and principles of operation of a fuel cell – classification of fuel cells, conversion efficiency of fuel cells. Types of electrodes, work output and emf of fuel cell,
Applications of fuel cells. Introduction about Hydrogen energy – hydrogen production – electrolysis, thermo chemical methods. Battery - Types of Batteries - Equivalent Electrical Circuit - Battery Charging - Charge Regulators - Battery Management

MAGNETIC AND ELECTRIC ENERGY STORAGE SYSTEMS

Superconducting Magnet Energy Storage (SMES) systems; capacitor and batteries: comparison and application; super capacitor: Electrochemical Double Layer Capacitor (EDLC), principle of working, structure, performance and application

ADVANCED BATTERIES FOR EV APPLICATIONS

Ultracapacitors: Features- Basic Principles of Ultracapacitors - Performance of Ultracapacitors – Mathematical model, Fuel cells: Operating Principles – Characteristics - Polarization loss - fuel cells Technologies - Comparison of fuel cells, Hybridization of Energy Storage systems.

TEXTBOOK
1. S.P.Sukatme, 'Solar Energy – Principles of thermal collection and storage,' Second edition, McGraw Hill,2007.
2. Mukund R. Patel, 'Wind and Solar Power Systems: Design, Analysis, and Operation, Second Edition, CRC Press, 2009

REFERENCES

COURSE DESIGNERS

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

POWER SYSTEM AND SMART GRID		Category	L	T	P	C
		EC- PS	3	0	0	3

Preamble

To enable the students acquire knowledge on power system planning and fault condition, smart grid, different options of architectural design, renewable energy sources and storage integration with smart grid.

PREREQUISITE : Nil

COURSE OBJECTIVES

1	To model the power system under steady state operating condition.
2	To model and carry out short circuit studies on power system.
3	To understand the basic concepts, components and architecture of smart grid

COURSE OUTCOMES

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

CO 1	Construct a power system model under steady state operating condition	Apply
CO 2	Experiment with the various fault and carry out short circuit studies on power system	Apply
CO 3	Define the smart grids components and architecture	Remember
CO 4	Find the various renewable energy sources to reduce pollution	Remember
C0 5	List the role of batteries and energy storages	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	L	-	-	M	M	L	-	L	-	-	-
CO2	L	S	L	M	S	-	-	M	M	L	-	-	-	M	-
CO3	S	-	S	S	S	-	-	M	M	L	-	M	-	-	-
CO4	S	S	M	-	S	-	-	M	M	L	-	-	-	-	L
CO5	S	-	S	M	S	M	-	S	M	L	-	-	-	-	-

SYLLABUS

POWER SYSTEM

Need for system planning and operational studies - Power scenario in India - Power system components –

Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram - Network graph, Bus incidence matrix, Primitive parameters, Bus admittance matrix from primitive parameters.

FAULT ANALYSIS

Assumptions in short circuit analysis - Symmetrical short circuit analysis using Thevenin's theorem - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - unsymmetrical fault occurring at any point in a power system

INTRODUCTION TO SMART GRID

Today's Gird Versus Smart Grid, Rationale for Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, Shareholders Roles and Function, Architecture, Functions of Components

DISTRIBUTED GENERATION

Solar Energy, PV Systems, Wind turbine Systems, Biomass, Small and Micro Hydro Power, Fuel Cell, Geothermal heat pumps.

ENERGY STORAGE

Batteries, Flow Batteries, Fuel Cell and hydrogen electrolytes, Flywheel, Super conduction magnetic energy storage systems, super capacitors, Simulation and case studies.

TEXTBOOK

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2008.
2. James Momoh, "Smart Grid: Fundamentals of design and analysis", John Wiley & sons Inc, IEEE press 2012.

REFERENCES

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
2. Fereidoon P. Sioshansi, "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Academic Press, 2012.
3. Qi Huang, Shi Jing "Innovative Testing and Measurement Solutions for Smart Grid", John Wiley & Sons Inc, 2015.

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	K.S.Kavitha Kumari	Assistant Professor (Gr-II)	EEE/AVIT	kavitha.eee@avit.ac.in
2	A.Balamurugan	Assistant Professor	EEE/VMKVEC	balamurugan@vmkvec.edu.in

	DIGITAL SIGNAL PROTECTION FOR POWER SYSTEMS	Category	L	T	P	Credit
		EC- PS	3	0	0	3

PREAMBLE

The technology of power system protection has evolved a lot since the era of electromechanical and solid-recorded by Current Transformers (CT) and Voltage Transformers (VT), by using digital
signal processing techniques. Thus, the requirement of learning this subject has changed significantly over a period of time and in fact, this subject addresses this need in a comprehensive manner.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	Study of numerical relays.
2	Developing mathematical approach towards protection
3	Study of algorithms for numerical protection.

COURSE OUTCOMES

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

CO1: Learn the importance of Digital Relays	Understand
CO2: Apply Mathematical approach towards protection	Apply
CO3: Learn to develop various Protection algorithms	Understand
CO4: Simulate protection for abnormalities in virtual environment	Analyze
CO5: Demonstrate primitive relays at contingency state	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	L	-	-	-	-	-	L	-
CO2	S	M	S	L	M	-	L	M	-	-	-	-	M	-	M
CO3	S	-	-	-	M	-	-	-	-	-	-	-	-	M	S
CO4	S	-	-	-	M	-	-	-	-	-	-	-	M	-	-
CO5	S	M	S	L	M	-	L	M	-	M	M	-	-	-	L
CO6	S	-	-	-	M	-	L	L	-	-	-	-	-	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit-1

DIGITAL RELAYS

Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection, Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection

Unit-2

SIGNAL PROCESSING

Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis

Unit-3

SIGNAL CONDITIONING

Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing, Error, sample and hold circuits, multiplexers, analog to digital conversion, Digital filtering concepts, The digital relay as a unit consisting of hardware and software

Unit-4

ALGORITHMS FOR RELAY OPERATIONS

Sinusoidal wave based algorithms, ample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms, Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm, Least Squares based algorithms. Differential equation based algorithms, Traveling Wave based Techniques.

Unit-5

DIGITAL PROTECTION OF POWER SYSTEMS

Digital Differential Protection of Transformers, Digital Line Differential Protection, Recent Advances in Digital Protection of Power Systems.

TEXT BOOKS:

1. Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006
2. S.R.Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014

REFERENCE BOOKS:

1. A.G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press,

2009				
2. A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press,1999				

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
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2	Mr. V.Rattankumar	Assistant Professor	EEE	rattankumar@avit.ac.in

	DESIGN OF ELECTRICAL APPARATUS	Category	L	T	P	Credit
		EC- PS	3	0	0	3

PREAMBLE.
This course offers the preliminary instructions and techniques to design the main dimensions and other major part of the transformer and DC and AC rotating machines. The course also provides the students with an ability to understand the step by step procedure for the complete design of electrical machines.

PREREQUISITE
         NIL

COURSE OBJECTIVES

1	To study mmf calculation and thermal rating of various types of electrical machines.
2	To design Armature and field systems for D.C. machines.
3	To design Core, yoke, windings and cooling systems of transformers.
4	Design of stator and rotor of induction machines and synchronous machines
5	To design stator and rotor of synchronous machines

COURSEOUTCOMES

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

CO1	Understand basics of design considerations for rotating and static electrical machines	Understand
CO2	Design armature and field of DC machines.	Create
CO3	Design sing and three phase transformer.	Create
CO4	Design stator and rotor of induction motor.	Create
CO5	Design and analyze synchronous machines.	Analyze

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

ELECTRICAL MACHINES DESIGN

Major considerations in Electrical Machine Design-Concept of magnetic circuit – MMF calculation for various types of electrical machines -Flux leakage – Leakage in Armature-Design of lap winding and wave winding-thermal rating: continuous, short time and intermittent short time rating of electrical machines

DC MACHINES

Construction - Output Equations – Main Dimensions – Choice of specific loadings – Choice of number of poles – Armature design – Design of commutator and brushes – Losses and efficiency calculation

TRANSFORMERS

Construction details –Output rating of single and three phase transformers – Overall dimensions – design of core, Yoke and winding for core and shell type transformers – Estimation of No load current – Temperature rise in Transformers – Design of Tank and cooling tubes of Transformers– Losses and efficiency calculation

INDUCTION MOTORS

Construction details- Output equation of Induction motor – Main dimensions – choice of specific loadings — Length of air gap- Rules for selecting rotor slots of squirrel cage machine- Design of squirrel cage rotor and wound rotor –Magnetic leakage calculations – Operating characteristics : Magnetizing current - Short circuit current – Circle diagram.

SYNCHRONOUS MACHINES

Constructional details-Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of rotor –Design of damper winding – Design of field winding – Design of turbo alternators

TEXTBOOKS
1. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.
2. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai& Sons, New Delhi, Fifth Edition, 1984.

REFERENCES
1. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Lt, 2011.
2. A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint 2007.

COURSEDESIGNERS

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1	D.SARANYA	Assistant Professor (Gr-II)	EEE/AVIT	dsaranya@avit.ac.in
2	G.RAMAKRISHNA PRABU	Associate Professor	EEE/VMKVEC	ramakrishnaprabu@vmkvec.edu.in

	HVDC TRANSMISSION SYSTEMS	Category	L	T	P	Credit
		EC- PS	3	0	0	3

PREAMBLE:

This course aims to develop the skills in the area of HVDC power transmission with the analysis of HVDC converters, harmonics and design of filters. This course also helps the students to learn Reactive power control, Power factor improvements of the system, HVDC cables and simulation

PREREQUISITE : NIL

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	Identify the application of HVDC system with practical examples
6	Explain HVDC Cables and simulation of systems

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	Understand
CO4	Design suitable controller for HVDC converter to obtain desired output	Apply
CO5:	Explain the application of HVDC system with practical examples	Apply
CO6	Explain HVDC Cables and simulation of 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	M	L	-	-	-	L	-		-	-	-	-	-	-	-
CO2	L	L	-	M	-	L	-	M	-	M	L	M	-	M	-
CO3	S	M	-	-	-	M	M	-	-	-	M	M	-	M	-
CO4	S	S	M	-	M	L	L	S	-	S	S	-	L	S	-
CO5	M	M	L	M	S	S	M	L	-	S	S	-	-	S	L
CO6	M	L	-	-	S	L	-	S	-	S	S	S	-	M	-

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

TRENDS FOR HVDC APPLICATIONS
Wind Farm Technology- Modern Voltage Source Converter (VSC)- 800 kV HVDC System- Practical examples of an HVDC system

HVDC CABLES AND SIMULATION OF HVDC SYSTEMS
Introduction of DC cables – Basic physical phenomenon arising in DC insulation – Practical dielectrics – Dielectric stress consideration – Economics of DC cables compared with AC cables. Introduction to system simulation – Philosophy and tools – HVDC system simulation – Modeling of HVDC systems for digital dynamic simulation

TEXT BOOK

1. Chan-Ki Kim, "HVDC Transmission Power Conversion Applications in Power Systems", John Wiley & Sons Pvt. Ltd., 2009.
2. K.R.Padiyar, "HVDC Power Transmission Systems", New Age International (P) Ltd., New Delhi, 2002.

REFERENCE BOOKS

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993
2. J.Arrillaga, "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
3. Erich Uhlmann, "Power Transmission by Direct Current", BS Publications, 2004.
4. V.K.Sood, "HVDC and FACTS controllers – Applications of Static Converters in Power System", Kluwer Academic Publishers, 2004.
5. Dragan Jovcic, Khaled Ahmed, "High Voltage Direct Current Transmission: Converters, Systems and DC Grids", John Wiley & Sons, Ltd, ISBN:9781118846667, 2015.
6. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age Interantional (P) Ltd., New Delhi, 1990

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	Mrs.P.Poornima	AP(Gr-II)	EEE/AVIT	poornima@avit.ac.in

	ENERGY AUDIT AND CONSERVATION	Category	L	T	P	C
		EC- PS	3	0	0	3

Preamble

In the modern world conservation of energy play a major role. As per the statistics 70% of the energy is lost in transmission and energy theft. Hence more emphasis is needed on energy conversation and for that energy audit has to be done. Energy audit gives the scope of various methods and tools to be followed for energy conservation.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To understand the basics of electrical energy and energy conservation
2	To analyze the electrical and thermal performance of an electrical system
3	To understand the financial impact of energy management
4	To apply the role of energy monitoring in energy management
5	To understand various aspects of energy audit.

COURSE OUTCOMES

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

CO1	Apply the knowledge of the subject to calculate the efficiency of various thermal utilities.	Remember
CO2	Design suitable energy monitoring system to analyze and optimize the energy consumption in an organization.	Understand
CO3	Improve the thermal efficiency by designing suitable systems for heat recovery and co-generation	Apply
CO4	Use the energy audit methods learnt to identify the areas deserving tighter control to save energy expenditure	Apply
CO5	Carry out the cost- benefit analysis of various investment alternatives for meeting the energy needs of the organization.	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
Commercial and Non-commercial energy-Primary energy resources-Commercial energy production-Final energy consumption-Indian energy scenario-Sectoral energy consumption(domestic, industrial and other sectors)-Energy needs of growing economy- energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its impotance, energy strategy for the future, Energy Conservation Act 2001 and its features.

ELECTRIC AND THERMAL PERFORMANCE
Electricity basics - Direct Current and Alternative Currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature and pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity and heat transfer. calculation of heat loss - heat gain, estimation of annual heating & cooling loads, factors that influence thermal performance, analysis of existing buildings setting up an energy management programme and use management - electricity saving techniques

ENERGY MANAGEMENT AND FINANCIAL ANALYSIS
Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering Investment-need, appraisal and criteria, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows

MONITORING OF ENERGY
Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)

ENERGY EFFICIENCY
Energy efficiency in thermal utilities like boilers, furnaces, pumps and fans , compressors, cogeneration (steam and gas turbines), heat exchangers ,lighting system, Motors belts and drives, refrigeration system. Heat recovery from ventilation, air co-generation of heat and electricity, heat recovery and bottoming cycles

TEXTBOOK
1.W. F. Kenny, Energy Conservation In Process Industry. 2.Amlan Chakrabarti, Energy Engineering and Management, Prentice hall India 2011 3.CB Smith, Energy Management Principles , Pergamon Press, New York

REFERENCES

1.Hand outs New Delhi, Bureau of energy efficiency
2.W. C. Turner, John Wiley and sons, Energy Management Hand Book.

COURSE DESIGNERS

Sl No	Name of the Faculty	Designation	Department	Mail ID
1	V.RATTAN KUMAR	AP(II)	EEE	rattankumar@avit.ac.in

	INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE

commercialization of innovation and new products in fast-paced, high-tech markets and matching technological innovation to market opportunities.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To make students understand multiple-perspective approach in organization to capture knowledge and creativity to develop successful products and services for Volatile, Uncertain, Complex and Ambiguous (VUCA) world.
2	Inculcate a disruptive thought process to generate ideas for concurrent and futuristic problems of society in general and markets in particular which focus on commercialization
3	Improved understanding of organizational best practices to transform exciting technology into successful products and services
4	Critically assess and evaluate innovation policies and practices in organizations especially from a cultural and leadership point of view
5	Explain why innovation isessential to organizational strategy – especially in a global environment

COURSE OUTCOMES

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

CO1: Understand the role of innovation in gaining and maintaining competitive advantage	Understand
CO2: Integrate the innovation basis and its role in decision making especially under uncertainty	Apply
CO3: Analyze business challenges involving innovation management	Apply
CO4: Having problem solving ability – solving social issues and business problems	Apply
CO5: Comprehend the different sources of innovation	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

Pre-launch, during launch and Post launch
preparations;

SYLLABUS:

Introduction to Innovation Management - Innovation – What it is? Why it Matters? - Innovation as a Core Business Process – system thinking for innovation – Framework for System Thinking - system thinking tools

Creating New Products and Services - Product and Service Innovation – Exploiting Open Innovation and Collaboration –The Concept of Design Thinking and Its Role within NPD and Innovation – framework for design thinking

Capturing Innovation Outcome - New Venture – Benefits of Innovation, and Learning from Innovation – Building Innovative Organization and Developing Innovation Strategy - Globalization for Innovations, Innovating for Emerging Economies and Role of National Governments in Innovation

New Product Brand Development and Pricing Strategies - Importance of Brand decisions and Brand identity development; Pricing of a new product, Pre-test Marketing

The Product offer Selecting Market opportunity and Designing new market offers-Concept Generation and Evaluation, Developing and Testing Physical offers - Pre-launch, during launch and Post launch preparations;

Text Book:

1. Joe Tidd, John Bessant (2013), Managing Innovation: Integrating Technological, Market and Organizational Change, 5th edition, Wiley.

Reference Books:

1. Schilling, M (2013), Strategic management of technological innovation, 4th edition, McGraw Hill Irwin.
2. Allan Afuah (2003), Innovation Management: Strategies, Implementation and Profits, 2nd edition, Oxford University Press.
3. Michael G. Luchs, Scott Swan, Abbie Griffin (2015), Design Thinking: New Product Development Essentials from the PDMA, Wiley-Blackwell.
4. John Boardman, Brian Sauser (2013), Systemic Thinking: Building Maps for Worlds of Systems, 1st edition, Wiley.
5. Rich Jolly (2015), Systems Thinking for Business: Capitalize on Structures Hidden in Plain Sight, Systems Solutions Press

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COURSE DESIGNERS:

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1	Dr. G. Murugesan	Professor	Management Studies	murugesan@vmkvec.edu.in
2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

NEW VENTURE PLANNING AND MANAGEMENT	Category	L	T	P	Credit
	OE- IE	3	0	0	3

PREAMBLE

Contemporary methods and best practices for the entrepreneur to plan, launch, and operate a new venture and creation of a business plan

PREREQUISITE - Not Required

COURSE OBJECTIVES

1	An opportunity for self-analysis, and how this relates to success in an entrepreneurial environment.
2	Information and understanding necessary to launch and grow an entrepreneurial venture.
3	A realistic preview of owning and operating an entrepreneurial venture.
4	An entrepreneur must understand the diversity, emotional involvement, and workload necessary to succeed.
5	The opportunity to develop a business plan.

COURSE OUTCOMES

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

CO1: Explain the concept of new venture planning, objectives and functions and its components.	Understand
CO2: Analyze the business plan issues and remuneration practices in startups business.	Apply
CO3: Explore an entrepreneurial idea to the point where you can intelligently and decide whether to "go for it" or not.	Apply
CO4: Compare and contrast the different forms entrepreneurial environment in terms of their key differences and similarities.	Apply
CO5: Explore the business plan and business model canvas for your idea.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	M	-	-	-	-	M	S	S	-	M	-	-
CO2	S	S	S	M	M	M	-	-	-	-	-	-
CO3	S	S	S	M	M	M	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-
CO5	S	S	S	M	M	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS:

STARTING NEW VENTURE: Opportunity identification - Search for new ideas - Sources of innovative

ideas - Techniques for generating ideas - Entrepreneurial imagination &creativity - The role of creative thinking - Developing your creativity - Impediments to creativity.

METHODS TO INITIATE VENTURES: Pathways to new venture - Creating new ventures - Acquiring an existing venture - Advantages of acquiring an established venture - Examination of key issues – Franchising - How a franchise works and franchise law - Evaluating franchising opportunity.

THE SEARCH FOR ENTREPRENEURIAL CAPITAL: The venture capital market - Criteria for evaluating new venture proposals - Evaluating venture capitalists - stage of venture capital financing - Alternate sources of financing for Indian entrepreneurs - Bank funding - State financial corporations - Business incubators and facilitators - Informal risk capital - Angel investors.

THE MARKETING ASPECTS OF NEW VENTURE: Developing a marketing plan - Customer analysis - Sales analysis - Competition analysis - Market research - Sales forecasting - Sales Evaluation - Pricing decisions.

BUSINESS PLAN PREPARATION FOR NEW VENTURE: Business plan concept - Pitfalls to avoid in business plan - Developing a well conceived business plan - Elements of a business plan - Harvest strategy - Form of business organization - Legal acts governing businesses in India .

Text Book:
1. The Successful Business Plan, Secrets & Strategies, Rhonda Abrams, Published by The Planning Shop Titan, Ron Chernow, Random House
2. Osterwalder, A. and Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Hoboken, NJ: John Wiley & Sons

Reference Books:
1. Blackwell, E. (2011). How to Prepare a Business Plan: Create Your Strategy; Forecast Your Finances; Produce That Persuasive Plan. Kogan Page Publishers.
2. Levi, D. (2014). Group Dynamics for Teams. Sage Publications, Inc. Thousand Oaks.
3. Rajeev Roy, 'Entrepreneurship' 2nd Edition, Oxford University Press, 2011.
4. Business Model Generation by Osterwalder and Pigneur.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1	Dr. G. Murugesan	Professor	Management Studies	murugesan@vmkvec.edu.in
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	SOCIAL ENTREPRENEURSHIP	Category	L	T	P	Credit
		OE- IE	3	0	0	3

PREAMBLE
Social entrepreneurship involves the creativity, imagination and innovation often associated with entrepreneurship.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To provide students with a working knowledge of the concepts, opportunities and challenges of social entrepreneurship..
2	To demonstrate the role of social entrepreneurship in creating innovative responses to critical social needs (e.g., hunger, poverty, inner city education, global warming, etc)..
3	To engage in a collaborative learning process to develop a better understanding of the context and domain of social entrepreneurship..
4	To help prepare you personally and professionally for meaningful employment by reflecting on the issues of social entrepreneurship.
5	Engage with a diverse group of social entrepreneurs

COURSE OUTCOMES

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

CO1: Explain the concept social entrepreneurship and distinguish its elements from across a continuum of organizational structures from traditional nonprofits to social enterprises to traditional for profits	Understand
CO2: Analyze the operations of a human service organization using social entrepreneurial orientation and industry assessment and diagnostic tools.	Apply
CO3: Apply the Social Business Model Canvas and lean startup methods for planning, developing, testing, launching and evaluating social change ventures.	Apply
CO4: Compare funding options for social change ventures.	Apply
CO5: The outcomes of social entrepreneurship are focused on addressing persistent social problems particularly to those who are marginalized or poor.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012
CO1	M	-	-	-	-	M	S	S	-	M	-	-
CO2	S	S	S	M	M	M	-	-	-	-	-	-
CO3	S	S	S	M	M	M	-	-	-	-	-	-
CO4	S	S	S	M	M	M	-	-	-	-	-	-

CO5	S	S	S	M	M	M	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Social entrepreneurship – dimensions of social entrepreneurship – social change theories – equilibrium and complexity – theory of social emergence

Social entrepreneurs – mindset, characteristics and competencies – developing a social venture sustainability model – feasibility study – planning – marketing challenges for social ventures

Microfinance– MFI (Micro Finance Institutions) in India – regulatory framework of MFI – Banks and MFIs – sustainability of MFI – Self Help Groups– successful MFI models

Angel Investors & Venture Capitalists – difference – valuation of firm – negotiating the funding agreement – pitching idea to the investor

Corporate entrepreneurship – behavioral aspects – identifying, evaluating and selecting the opportunity – venture– location – organization – control – developing business plan – funding the venture – implementing corporate venturing in organization.

Text Book:
1. Constant Beugré, Social Entrepreneurship: Managing the Creation of Social Value, Routledge, 2016.

2. Björn Bjerke, Mathias Karlsson, Social Entrepreneurship: To Act as If and Make a Difference, Edward Elgar Publishing, 2013.

Reference Books:
1. Wei-Skillern, J., Austin, J., Leonard, H., & Stevenson, H. (2007). Entrepreneurship in the Social Sector (ESS). Sage Publications.
2. Janus, K. K. (2017). Social startup success. New York, NY: Lifelong Books.
3. Dancin, T. M., Dancin, P. A., & Tracey, P. (2011). Social entrepreneurship: A critique and future directions.
4. Alex Nicholls, Social Entrepreneurship: New Models of Sustainable Social Change, OUP Oxford, 2008.
5. David Bornstein, Susan Davis, Social Entrepreneurship: What Everyone Needs to Know, Oxford University Press, 2010.

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
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17MBHS01	ENGINEERING STARTUPS AND ENTREPRENEURIAL MANAGEMENT	Category	L	T	P	Credit
		OE- IE	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: Nil

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.	Evaluates

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	-	L	L
CO2	S	S	M	M	M	L	-	-	-	-	-	M	L	L	-
CO3	S	S	S	M	M	M	-	-	-	-	-	M	L	-	M
CO4	S	S	S	M	M	M	-	-	-	-	-	M	-	M	L
CO5	S	S	-	M	M	M	-	-	-	-	-	M	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS:

Elements of a successful Start up: Startup Process – Create Management Team and Board of Directors – Evaluate market and Target Customers – Define your product or service – preparation of business plan -

specific problems and challenge in startup.

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 – Equity Ownership – 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.

Startup Capital Requirements and Legal Environment:

Identifying Startup capital Resource requirements - estimating Startup cash requirements - Develop financial assumptions- Constructing a Process Map - Positioning the venture in the value chain - Launch strategy to reduce risks- Startup financing metrics - The Legal Environment- Approval for New Ventures- Taxes or duties payable for new ventures..

Text Book:

1. James A. Swanson & Michael L. Baird, "Engineering your start-up: A Guide for the High-Tech Entrepreneur" 2nd ed, Professional Publications.inc
2. Donald F Kuratko, " Entrepreneurship – 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:

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	INTELLECTUALPROPERTY RIGHTS	Category	L	T	P	Credit
		OE-IE	3	0	0	3

PREAMBLE: The course is designed to introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

PREREQUISITE: Nil

COURSE OBJECTIVES:

1. To introduce fundamental aspects of Intellectual property Rights

2. To disseminate knowledge on patents and copyrights

3. To disseminate knowledge on trademarks, Design and Geographical Indication (GI),

4. To disseminate knowledge onPlant Variet, Layout Design Protection and create awareness about current trends in IPR

5. To disseminate knowledge onLegislation of IPRs and Alternate Dispute Resolution

COURSE OUTCOMES:

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

CO1: Understand the important of intellectual property rights	Understand
CO2: Apply for the patents	Apply
CO3: Understand and apply for the copyrights	Understand
CO4: Understand the important of trademarks	Apply
CO5: Appreciate the importance of IPR and its related issues	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	L	-	-	-	-	L	S	L	-	L	-	L	L	M	-
CO2	L	S	S	M	M	L	-	-	-	-	-	L	M	L	-
CO3	L	S	L	M	M	L	-	-	-	-	-	L	M	L	-
CO4	L	S	S	S	M	L	-	-	-	-	-	L	L	L	-
CO5	L	S	S	M	-	L	-	-	-	-	-	L	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Unit 1 - Overview of Intellectual Property

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in

abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994.

Unit 2 - Patents & Copyright

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Copyright - Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

Unit 3 – Trademarks, Design and Geographical Indication (GI)

Trademarks: Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

Design: Meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI): Meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

Unit 4 - Plant Varieties, Layout Design and Indian National Intelectual Property Policy

Plant Variety Protection: Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection.

Layout Design Protection: Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection.

Indian National Intelectual Property Policy: India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes in IPR – Career Opportunities in IP - IPR in current scenario with case studies

UNIT – V: Legislation of IPRs and Alternate Dispute Resolution

Legislation of IPRs: The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act,

Geographical Indication Act, Bayh- Dole Act - Patent Ownership and Transfer, Patent Infringement, International Patent Law

Alternate Dispute Resolution: Alternate Dispute Resolution and Arbitration – ADR Initiatives –Reason for Choosing ADR – Advantages and Disadvantages of ADR – Assessment of ADR's – Litigation – Arbitration - Effective Mechanism for Business Issues.

Text Books:
1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., &Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference Book:
1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

COURSE DESIGNERS:

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2	A. Mani	Associate Professor	Management	mani@vmkvec.edu.in

	PRINCIPLES OF BIOMEDICAL INSTRUMENTATION	Category	L	T	P	
		OE-EA	3	0	0	

PREAMBLE

Toenablethestudentstodevelopknowledgeofprinciples,designandapplicationsof theBiomedical Instruments.

PREREQUISITE–NIL

COURSEOBJECTIVES

1	Toknowaboutbioelectricsignals,electrodesanditstypes.
2	ToknowthevariousBiopotentialrecording methods.
3	TostudyaboutpatientmonitoringconceptandvariousPhysiologicalmeasurementsmethods.
4	Tostudytheprincipleofoperationbloodflowmeter,bloodcellscounter.
5	Tostudyaboutbiochemicalmeasurementsanddetailstheconceptofbiotelemetryandpatientsafety.

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentswillbeableto

CO1. Explainthedifferent Biosignalor biopotential.	Understand
CO2. Discusstheworkingprinciplesofdiagnosticandtherapeuticequipments.	Understand
CO3. ExaminethevariousinstrumentslikeasECG,EMG,EEG,X-ray machine.	Apply
CO4. Illustratemedicalinstrumentsbasedonprinciplesandapplicationusedin hospital.	Analyze
CO5. Analyzeandcalibratefundamentalbiomedicalinstrumentationusedin hospital.	Analyze

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFIC OUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

BIOELECTRICSIGNALSANDELECTRODES

Basicmedicalinstrumentationsystem, OriginofBioelectricPotential, Recordingelectrodes–ElectrodeTissueinterface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artifacts. Electrodes – Silver – silver electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical conductivity of electrode jel creams, Microelectrodes.

BIOAMPLIFIERANDBIOMEDICAL RECORDERS

Bioamplifier, Need for Bioamplifier, Differential amplifier, Instrumentation amplifier, Chopper amplifier, I Amplifier, ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform.

PATIENTMONITORINGSYSTEMANDNONELECTRICALPARAMETERS MEASUREMENTS

System concepts of patient monitoring system, Bedside patient monitoring system, central monitors, Blood p

measurement,Measurementoftemperature,Respirationratemeasurement,cardiacoutputmeasurement,Measuremento
rate, Plethysmography technique.

BLOODFLOWMETERS, BLOODCELL COUNTERS
Electromagnetic blood flow meter, ultrasonic blood flow meter, Laser Doppler blood flow meter, Types of bloo
Methods of cell counting, coulter counters, automatic recognition and differential counting.

BIO-CHEMICALMEASUREMENTSANDBIOTELEMETRYANDPATIENTSAFETY
Ph, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto-a
Biotelemetry-wireless telemetry, single channel telemetry, multichannel telemetry, multi patient telemetry.

TEXT BOOKS:
      1. KhandpurR.S,**"Hand-bookofBiomedicalInstrumentation"**,TataMcGrawHill,2ndEdition,2003.
  2. LeslieCromwell,FredWeibellJ,ErichPfeiffer.A,**"BiomedicalInstrumentationandMeasurements"**, Prentio
India, 2nd Edition, 1997.

REFERENCES:
      1. JohnG.Webster,**"MedicalInstrumentationapplicationanddesign"**,JohnWiley,3rdEdition, 1997.
Carr,JosephJ,Brown,John.M,**"IntroductiontoBiomedicalequipmenttechnology"**,JohnWileyandsons, New York
Edition, 1997.

COURSEDESIGNERS

S.No.	Nameofthe Faculty	Designation	Department	Mail ID
1	Dr.N.Babu	Professor	BME	babu@vmkvec.edu.in
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		Category	L	T	P	Credit

BIOSENSORSANDTRANSDUCERS	OE-EA	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

COURSEOBJECTIVES

1	Tousethebasicconceptsoftransducers,electrodes andits classification.
2	Todiscussthevarious typesof electrodes.
3	Todeterminetherecordingofbiological components.
4	Toemploytheknowledgeinelectrochemicalandopticalbiosensors.
5	Tooutlinethevariousbiologicalcomponentsusing biosensors.

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentswillbeableto

CO1. Describetheworkingprinciples of transducers.	Understand
CO2. Explainthevarious typesof electrodes.	Understand
CO3. UtilizevariousFETsensorsforrecordingofbiologicalcomponents.	Apply
CO4. Distinguishvariousbiosensorslikeelectrochemicalandopticalbiosensors.	Analyze
CO5. Analyzethebiologicalcomponentsusingbiosensorsinvarious applications.	Analyze

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFIC OUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTION: General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

TRANSDUCERS:
Temperaturetransducers,piezoelectrictransducers,Piezoresistivetransducers,photoelectrictransducers.

BIOPOTENTIAL ELECTRODES:
Half cell potential, Types of Electrodes –Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemicalelectrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

BIOSENSORS:
Biologicalelements,Immobilizationofbiologicalcomponents,ChemicalBiosensor-ISFET,IMFET,electrochemical sensor,

chemical fibro sensors.

APPLICATIONSOFBIOSENSORS:
Bananatrode,bloodglucosesensors,noninvasivebloodgasmonitoring,UREASEbiosensor,Fermentationprocess control, Environmental monitoring, Medical applications.

TEXT BOOKS:
1. H.S.Kalsi,**"ElectronicInstrumentation&Measurement"**,TataMcGrawHILL,1995.
2. BrainREggins,**"Biosensors:AnIntroduction",**JohnWileyPublication,1997.
3. Shakthichatterjee,**"BiomedicalInstrumentation"**,CengageLearning,2013.
4. JohnGWebster, **"MedicalInstrumentation:Applicationanddesign"**,JohnWileyPublications,2001.

REFERENCES:
1. K.Sawhney,**"AcourseinElectronicMeasurementsandInstruments"**,DhapatRai&sons,1991.
2. JohnPBentley,**"PrinciplesofMeasurementSystems"**,3rdEdition,PearsonEducationAsia,(2000Indianreprint).
GeddesandBaker,**"PrinciplesofAppliedBiomedicalInstrumentation"**,3rdEdition,JohnWileyPublications, 2008.

COURSEDESIGNERS				
S.No.	**Nameofthe Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.L.K.Hema	Professor&Head	BME	hemalk@avit.ac.in
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3	Mr.V.Prabhakaran	AssistantProfessor(Gr-II)	BME	Prabhakaran.bme@avit.
4	Mrs.S.Vaishnodevi	AssistantProfessor	BME	vaishnodevi@vmkvec.e

		Category	L	T	P	Credit
INTRODUCTION TO BIOFUELS	**OE-EA**	**3**	**0**	**0**	**3**

PREAMBLE

This course will provide an overview of existing energy utilization, production and infrastructure. We will also cover the consequences of our energy choices on the environment. The topics covered will include the chemistry of biofuels, the biology of important feedstocks, the biochemical, genetic and molecular approaches being developed to advance the next generation of biofuels and the economical and global impacts of biofuel production.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the different types and differences between existing energy resources.
2	To understand the improcurement, utilization and their impacts on society and environment
3	To gain knowledge about the existing different biofuels and the methods of production from different sources
4	To introduce the techonologies involved in the production, characterization of biofuels
5	To impacrt the knowledge and applications of biofuel in various sectors and their beneficial aspects to the society.

COURSE OUTCOMES

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

CO1. Understand the existing and emerging biomass to energy technologies	Remember
CO2. Understand the concept of 1st generation, 2nd generation and advance biofuels	Understand
CO3. Appraise the techno-economic analyses of biofuel conversion technologies	Understand
CO4. To articulate the concept of a biorefinery system and be able to develop major unit operations of an integrated biorefinery	Apply
CO5. Illustrate the environmental implications	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	-	-	-	-	S	-	L
CO2	-	S	S	-	M	-	L	-	-	-	-	-	-	S	L
CO3	S	M	-	M	-	M	-	L	L	-	-	-	S	-	L
CO4	-	S	M	-	M	L	L	-	-	-	-	-	-	S	M
CO5	-	-	-	-	-	-	-	S	M	-	-	-	-	-	L

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

OVERVIEW OF BIOFUELS
Generation of biofuels − Development of biological conversion technologies − Integration of biofuels into biorefineries − Energy security and supply − Environmental sustainability of biofuels − Economic sustainability of biofuels.

BIODIESEL
Biodiesel − Microorganisms and raw materials used for microbial Oil production − Treatment of the feedstocks prior to production of the Biodiesel − Current technologies of biodiesel production − Purification of biodiesel; Industrial production of biodiesel − Biodiesel production from single cell oil.

BIOETHANOL
Bioethanol − Properties − Feedstocks − Process technology − Pilot plant for ethanol production from lignocellulosic feedstock − Environmental aspects of ethanol as a biofuel.

BIOMETHANE AND BIOHYDROGEN
Biomethanol − Principles, materials and feedstocks − Process technologies and techniques − Advantages and limitations − Biological hydrogen production methods − Fermentative hydrogen production − Hydrogen economy − Advantages and limitations.

OTHER BIOFUELS
 Biobutanol production − Principles, materials and feedstocks − Process technologies − Biopropanol − Bioglycerol − Production of bio-oils via catalytic pyrolysis − Life-Cycle environmental impacts of biofuels and Co-products.

TEXT BOOKS:
1. Luque, R., Campelo, J.and Clark, J. Handbook of biofuels production, Woodhead Publishing Limited 2011 2. Gupta, V, K. and Tuohy, M, G. Biofuel Technologies, Springer, 2013 3. Moheimani, N. R., Boer, M, P, M, K, Parisa A. and Bahri, Biofuel and Biorefinery Technologies, Volume 2, Springer, 2015
REFERENCES:
1.Eckert, C, A. and Trinh, C, T. Biotechnology for Biofuel Production and Optimization, Elsevier, 2016 2. Bernardes, M, A, D, S. Biofuel production – recent developments and prospects, InTech,2011

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A.Balachandar	Assistant Professor – Gr-II	Biotechnology	balachandar.biotech@avit.ac.in
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	FOOD AND NUTRITION TECHNOLOGY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The course aims to enable the students to understand the physicochemical, nutritional, microbiological and sensory aspects, To familiarize the students about the processing and preservation techniques. To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	Understand the tradition food processing techniques and the basics concept of food biochemistry
2	Demonstrate the product development technique, quality and contaminant check
3	To articulate their technical knowledge for industrial purpose
4	Describe national food laws and standards
5	Laws and qualities of standard for food products

COURSE OUTCOMES

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

CO1: Recall the processing techniques practiced in olden days and the biological process	Remember
CO2. Illustrate the methods for animal product development, quality control and also screen the contaminant	Understand
CO3.Transfer the techniques in scaling up for industrial needs	Apply
CO4. Interpret and Troubleshoot instruments to maintain accuracy	Apply
CO5. Develop standards for food additives	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	L	M	S	M	L	-	-	-	-	-	-	-	M	L	-
CO4	M	S	S	M	L	-	-	-	-	-	-	-	S	S	-
CO5	-	S	S	M	M	-	-	-	-	-	-	M	L	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FOOD BIOTECHNOLOGY

Introduction, History and scope of food Biotechnology, development and prospects of biotechnology in animal products, ancient and traditional food processing techniques; Biochemical and metabolic pathways of biological systems used in food production.

METHODS IN FOOD BIOTECHNOLOGY: Role of biotechnology in productivity of livestock, Modern biotechnological methods and processes in animal product development, chemical and physical factors required for growing microbial cultures in nutritive substrate; Meat species identification, Quality control, Screening products for contaminants

BIOTECHNOLOGY METHODS IN FOOD PROCESSING:

Use of biotechnology in the production of food additives, use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, Basic principles of the industrial use of bio-reactions for production of biomass-upstream and downstream processing application of microorganisms as starter cultures in meat industry, microbial production of food ingredients; Biosensors and novel tools and their application in food science.

HURDLE TECHNOLOGY:

Principles and applications, Hurdle effect in fermented foods, shelf stable products, intermediate moisture foods, application of hurdle technology

FOOD SAFETY & SECURITY:

Consumer concerns about risks and values, biotechnology & food safety, Ethical issues concerning GM foods; testing for GMOs; current guidelines for the production, release and movement of GMOs; Future and applications of food biotechnology in India.

TEXT BOOKS:

1. Potter, Norman. M. Food Science, 5th Ed. Springer US

2. Manay, S.; Shadakshara Swamy, M., (2004). Foods: Facts and Principles, 4 th Ed. New Age Publishers.

3. B. Srilakshmi., (2002) Food Science, New Age Publishers.

REFERENCES:

1. Meyer, (2004). Food Chemistry. New Age

2. Deman JM. (1990) Principles of Food Chemistry. 2 nd Ed. Van Nostrand Reinhold, NY

3. Ramaswamy H and Marcott M. Food Processing Principles and Applications. CRC Press

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A.Nirmala	Assistant Professor GII	Biotechnology	nirmalabt@avit.ac,in
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	DISASTERRISK MANAGEMENT	Category	L	T	P	Credit
		OE – EA	3	0	0	**3**

PREAMBLE

PREREQUISITE

 NIL

COURSEOBJECTIVES

1	Tostudyabout theDisasterManagementCycles
2	ToStudyabouttheDisasterCommunityandplanning
3	ToUnderstandtheChallengesposedbyDisasterstothecommunity
4	Tostudyaboutcopingconceptsforbothnaturaland manmadedisasters
5	Tostudyaboutstrengtheningtechniquesforstructuralandnonstructuralmeasures

COURSE OUTCOMES

Onthesuccessfulcompletionofthe course,studentswillbeable to

CO1. UnderstandingDisasters,man-madeHazardsandVulnerabilities	UnderstandandApply
CO2. Understandingdisaster managementmechanism	Apply
CO3 Togainknowledgeabout organizationsinvolvedindisastercommunity	Apply
CO4. Tobuildskillstorespondtodisasters	Apply
CO5. Understandingcapacitybuildingconcepts andplanningofdisastermanagements	UnderstandandApply

MAPPING WITHPROGRAMMEOUTCOMES ANDPROGRAMMESPECIFICOUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	L	L	L	L	L	L	M	L	L	M	L	M	M	L	L	M
CO2	M	M	L	L	M	L	S	L	L	M	M	S	S	L	L	S
CO3	S	M	L	L	M	L	M	L	L	M	S	S	M	L	L	S
CO4	M	M	L	L	M	L	M	L	L	S	S	S	S	L	L	M
CO5	S	S	L	L	S	L	S	L	L	S	M	M	S	L	L	S

S-Strong;M-Medium;L-Low

SYLLABUS
UNITIINTRODUCTION

Overview of Disaster Management – Distinguishing between an emergency and a Disaster situation.Disaster Management Cycle – Disaster management Act and Policy in India; Organisational structurefordisastermanagementinIndia;Preparationofstateanddistrictdisastermanagementplans-PhaseI: Mitigation, and strategies; hazard Identification and vulnerability analysis. Disaster Mitigation

andInfrastructure,impactofdisastersondevelopmentprogrammes,vulnerabilitiescausedbydevelopment, developingadraftcountry-leveldisasteranddevelopmentpolicyPhaseII:Preparedness, Disaster Risk Reduction(DRR), Emergency Operation Plan (EOP) Phases III and IV:Response and recovery, Response aims, Response Activities, Modern and traditional responses todisasters,DisasterRecovery,andPlan

UNITII DISASTERPLANNING

DisasterPlanning-DisasterResponsePersonnelandduties,CommunityMitigationGoals,Pre-DisasterMitigationPlan,PersonnelTraining,VolunteerAssistance,School-basedProgrammes,HazardousMaterials,Waysofstoringandsafelyhandlinghazardousmaterials,CopingwithExposure

.
UNITIIIDISASTERCOMMUNITY
Disaster Community-Community-based Initiatives in Disaster management, need for Community-Based Approach, categories of involved organizations: Government, Nongovernment organizations(NGOs), Regional AndInternational Organizations, Panchayaths, Community Workers, NationalAnd Local Disaster Managers, Policy Makers, Grass-Roots Workers, Methods Of Dissemination OfInformation, Community-Based Action Plan, Advantages/Disadvantages Of The Community BasedApproach

UNITIV COPINGWITHDISASTER

Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - IndustrialSafetyPlan;Safetynormsand survivalkits-Massmediaand disastermanagement

UNITV CAPACITYBUILDING

Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity forReducing Risk - Counter-Disaster Resources and their utility in Disaster Management - LegislativeSupportatthestate andnationallevels
TEXTBOOKS:
1. ManualonDisaster Management, NationalDisasterManagement,AgencyGovtofIndia.
2. Ayaz,.“DisasterManagement:ThroughtheNewMillennium”,AnmolPublications.(2009)
3. Dave,P.K..“Emergency MedicalServicesandDisasterManagement:AHolisticApproach”,NewDelhi:JaypeeBrothersMedicalPublishers(P)Ltd.,2009
4. Disaster ManagementbyMrinaliniPandeyWiley2014.
5. Goel,S. L.,“DisasterManagement”,NewDelhi:Deep&DeepPublicationPvt. Ltd.,2008
REFERENCEBOOKS:
1. Narayan,B.“DisasterManagement”,NewDelhi:A.P.H.PublishingCorporation,2009
2. Kumar,N.. “DisasterManagement”.NewDelhi:AlfaPublications.,2009
3. Ghosh,G.K.,“DisasterManagement”,New Delhi:A.P.HPublishingCorporation.

S.No	NameoftheFaculty	Designation	Nameofthe College	MailID
1	MrsJ.Srija	AssistantProfessor-I	AVIT	srija.civil@avit.ac.in

	MUNICIPAL SOLID WASTE MANAGEMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Preamble

Structure is an arrangement and organization of interrelated elements in a material object or system, or the object or system so organized. Material structures include man-made objects such as buildings and machines and natural objects such as biological organisms, minerals and chemicals.

Prerequisite

Nil

Course Objectives

1.	The on-site/off-site processing of the same and the disposal methods.
2.	The student is expected to know about the various effects and disposal options for the municipal solid waste.
3.	The collection and supply of water
4.	The offsite processing involved in site

Course Outcomes

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

CO1. To know about the types of waste & Sources	Analyze
CO2 . To Study the on site Storage & Processing	Apply
CO3. To study about the collection & transfer the waste	Apply
CO4. To Study the process of off site processing	Apply
CO5. To know about the solid waste disposal	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
CO2	S	M	L	S	-	-	-	-	-	-	-	-		M	S
CO3	S	M	M	S	-	-	-	-	-	-	-	-		M	S
CO4	S	M	M	M	-	-	-	-	-	-	-	-		M	S
CO5	S	M	M	-	-	-	-	-	-	-	-	L		-	S

S- Strong; M-Medium; L-Low

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES

Sources and types of solid wastes-major legislation-monitoring responsibilities-Effects of disposal of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization– public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

ON-SITE STORAGE & PROCESSING

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

COLLECTION AND TRANSFER

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, Anaerobic digestion, RDF and Incineration and co-generation of energy using waste, Pyrolysis of solid Waste operation & maintenance; options under Indian conditions.

OFF-SITE PROCESSING

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions-cradle to grave management concept, Prevailing laws of hazardous waste management- Risk assessment.

DISPOSAL

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Text Books

1. George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-HillPublishers, 2002.

2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, "Waste Management",Springer, 1994.

3. Charles A. Wentz; "Hazardous Waste Management", McGraw-Hill Publication, Latest publication, (1992).

Reference Books

1. R.E.Landreth and P.A.Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997, Bhide A.D. and Sundaresan, B.B., "Solid Waste Management in Developing Countries",INSDOC, 1993.

2. Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous, McGraw Hill Publication, (2002), Bagchi, A., Design, Construction, and Monitoring of Landfills, (2nd Ed). Wiley Interscience, ISBN: 0-471-30681-9, Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development.

3. Government of India, New Delhi, (2000).

4. NPTEL – Municipal Soild Waste Management by Prof. Ajay Kalamdhad – IIT Guwahati.

	Category	L	T	P	Credit
FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	OE-EA	3	0	0	3

PREAMBLE
This syllabus is intended for the Engineering students and enable them to lean about Artificial Intelligence. This syllabus contains intelligent agent, Knowledge Representation and Game playing. Thus, this syllabus focuses on to know about AI and its concepts.

PREREQUISITE :NIL

COURSE OBJECTIVES

1.	To introduce the basic principles, techniques, and applications of Artificial Intelligence.
2.	To have knowledge of generic problem-solving methods in Artificial Intelligence.
3.	To design software agents to solve a problem.
4.	Apply the knowledge of algorithms to solve arithmetic problems.
5.	Assemble an efficient code for engineering problems.

COURSE OUTCOMES

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

CO1:. Identify the different agent and its types to solve the problems	Understand
CO2: know about the problem solving technique in Artificial Intelligence.	Apply
CO3: Construct the normal form and represent the knowledge.	Apply
CO4: to know about extension of condition probability and how to apply in the real time environment.	Apply
CO5: To lean about Information Retrieval and Speech Recognition	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	M	M	M	M	-	-	-	-	-	-	M	S	M	-
CO2	M	M	L	M	L	-	-	-	-	-	M	M	S	M	M
CO3	M		S	M	M	-	-	-	-	-	-	M	S	-	M
CO4	S	M	M	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	M	M	M	M	-	-	-	-	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

INTRODUCTION
What is AI? – AI Problems – What is an AI technique – Defining the problem as a state space search – Production system - Production system – Characteristics – Problem Characteristics?

HEURISTIC SEARCH TECHNIQUES
Generate and test – Hill Climbing – Best first Search – Problem Reduction – Constraints satisfaction – Means end analysis.

KNOWLEDGE REPRESENTATION
Propositional Logic-First Order Predicate Logic-Prolog Programming-Unification-Forward Chaining- Backward Chaining-Ontological Engineering-Categories and Objects-Events-Mental Events and Mental Objects.

REPRESENTING KNOWLEDGE USING RULES
Procedural versus – Declarative Knowledge – logic Programming – Forward versus Backward Reasoning – Matching

GAME PLAYING
The Minimax search procedure – Adding Alpha Beta cut offs – Addition Refinements – Waiting for Quiescence – Secondary Searches – Using Book moves.

TEXT BOOKS
1. S. Russell and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2015 Bratko, I., Prolog Programming For Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th Edition, 2011..

REFERENCES
1. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: A Logical Approach", Oxford University Press, 2004.   2. G. Luger, "Artificial Intelligence: Structures and Strategies For Complex Problem Solving", Fourth Edition, Pearson Education, 2002.   3. J. Nilsson, "Artificial Intelligence: A New Synthesis", Elsevier Publishers, 1998.

COURSE DESIGNERS				
S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Nitya	Professor	CSE	nithya@vmkvec.edu.in
2	Dr.M.Jayachandran	Professor	CSE	jayachandran@avit.ac.in

	INTRODUCTION TO INTERNET OF THINGS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Introduction to IoT for statistical data manipulation and analysis. It was inspired by and is most compatible with the statistical language.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To learn Introduction to IoT.
2	To Study methodology of IoT.
3	To Develop IoT applications using Arduino and Intel Edition.

COURSE OUTCOMES

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

CO1: To Understand the basics in Introduction to IoT in terms of constructs, control statements, string functions	Understand
CO2: To Understand the use of Introduction to IoT fundamentals.	Understand & Apply
CO3: Learn to apply Introduction to IoT for Communicating Sequential Process	Understand & Apply
CO4: Able to appreciate and apply the Introduction to IoT from a statistical perspective	Understand & Apply
CO5 To learn Introduction to IoT Challenges	Understand & 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	L	S	S	M	S	L	S	-	S	M	S
CO2												M	M	M	S
CO3	M	S	M	M	M	S	S	M	S	M	M	-	M	-	S
CO4												M	M	S	M
CO5	S	S	S	S	M	S	S	S	S	M	S	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS
UNIT I –INTRODUCTION to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs
.
UNIT II- IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network
UNIT III – Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination
UNIT IV – Domain specific applications of IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT V – Reflection, Low-Level Programming

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

TEXT BOOKS

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

REFERENCES

1. Macro Schewartz, "Internet of Things with the Arduino Yun" Packet Publishing, 2014.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Jayachandran	Professor	CSE	jayachandran@avit.ac.in
2	Dr.M.Nitya	Professor	CSE	nithya@vmkvec.edu.in

	CYBER SECURITY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE
To understand the need for Cyber Security in real time and to study techniques involved in it.

PREREQUISITE : NIL

COURSE OBJECTIVES

1.	To understand the fundamentals of Cyber Security and issues
2.	To study various cyber crimes and legal remedies
3.	To apply various privacy and security
4.	To study E-Commerce and digital payments
5.	To study the basic security aspects related to Computer and Mobiles

COURSE OUTCOMES

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

CO1: Able to understand the concept of Cyber security and issues and challenges associated with it.	Understand
CO2: Able to understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures	Apply
CO3: Able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.	Apply
CO4: Able to understand the basic concepts related to E-Commerce and digital payments.	Apply
CO5: Able to understand the basic security aspects related to Computer and Mobiles.	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	M
CO2	M	M	M	M	M	-	-	-	-	-	-	-	M	M	M
CO3	M	M	S	M	M	-	-	-	-	-	-	-	M	M	M
CO4	S	M	M	M		-	-	-	-	-	-	-	M	M	S
CO5	S	M	M	M	S	-	-	-	-	-	-	-	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CYBER SECURITY	9 hours
Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	

CYBER CRIME AND CYBER LAW	9 hours
Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.	

SOCIAL MEDIA OVERVIEW AND SECURITY	9 hours
Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	

E - C O M M E R C E AND DIGITAL PAYMENTS	9 hours
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payament Settlement Act,2007.	

DIGITAL DEVICES S E C U R I T Y , TOOLS AND TECHNOLOGIES FOR CYBER SECURITY 9 hours	
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	

REFERENCES
1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.   2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)   3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)   4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.   5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.   6. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. 7. Fundamentals of Network Security by E. Maiwald, McGraw Hill

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	Mr. B. Sundharamurthy	Assistant Professor	CSE	sundharamurthy@vmkvec.edu.in

	DESIGN OF ELECTRONIC EQUIPMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The objective of this course is to sensitise a registrant to various aspects of an electronics product. Specifically on non-Electrical aspects like mechanical design and detailing. Starting from a need translated into specifications, leading to design and prototyping and ending up in a manufacturable physical prototype.

PREREQUISITE – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES

1	*To understand the various Concept of Industrial Design process.*
2	*To apply the basic Concept of electronic Product designs methodology.*
3	*To classify the Concept of Ergonomics & aesthetics in product design.*
4	*To understand the Knowledge regarding the design of product packaging and working environment.*
5	*To understand the Knowledge of different industrial standard and value analysis.*

COURSE OUTCOMES

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

CO1. Visualize the concept for product design with respect to ergonomics and aesthetics.	Remember
CO2. Analyze, design and implement control panels of electronic equipment	Apply
CO3. Apply creativity in the design of system by formulating architecture with proper placement of components.	Apply
CO4. Apply the concept of visual communication techniques in product design.	Apply
CO5. Apply the process of value analysis in existing product.	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	-	-	S	-	-	L	M	L	-	-	S	-	-
CO2	M	L	-	M	S	-	-	L	M	L	-	-	S	-	-
CO3	M	L	-	M	S	-	-	L	M	L	-	L	S	-	M
CO4	S	M	L	-	S	-	-	L	M	L	-	L	S	M	M
CO5	S	M	L	-	S	-	-	M	L	L	-	L	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

MODULE 1: INTRODUCTION

Introduction to industrial design, Role of industrial design in the domain of industry, Generic product development process, ID process, Product innovations, tools and methods.

MODULE 2: PRODUCT PROTOTYPES

Management of ID process, Product architecture, Structure: standard and non-standard structures. Product prototypes.

MODULE 3: PRODUCT DESIGN AND PLANNING

Electronic product design and deve̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶ies, brainstorming documentation.

Product planning: Defining the task̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶̶sting and Pricing of Industrial design,

MODULE 4: ERGONOMICS

Ergonomics: Ergonomics of electronic equipment, Ergonomics of control panel design. Use of ergonomics at work places and plant layout. Aesthetics: Elements of aesthetics, aesthetics of control panel design.

MODULE 5: CASE STUDIES

Value engineering, Product quality and design management. Industrial standards, Graphics and packaging

TEXTBOOKS:

1. Carl T. Ulrich, Steven. D. Eppinger," "Product Design and Development", McGraw Hill Companies.

REFERENCE BOOKS:

1. Ernest J Mccormick ,"Human factors in Engineering and Design" -, McGraw-Hill Co.

2. Yammiyavar P," Control Panel Design and Ergonomics", CEDT/IISc Publication.

3. Murrell K, Chapman," Ergonomics: Man in his Working Environment", &Hall. London. Flurschiem C H, "Industrial Design and Engineering Design ", Council, London and Springer Verlag, 1983

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr.Rajat Kumar Dwibedi	Assistant Professor	ECE	rajatkumar.ece@avit.ac.in
2	Dr. L.K.Hema	Prof.&Head/ECE	ECE	hodece@avit.ac.in
3	Mr.G.Murali	Assistant Professor	ECE	muralig@vmkvec.edu.in

	INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Industry 4.0 and Industrial Internet of Things is the pioneer of today's modern technology. To match the engineering skills with the industry skills this subject will induce and impart the knowledge among the young professionals.

PREREQUISITE

   Basic knowledge of computer and internet

COURSE OBJECTIVES

1	*Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing.*
2	*Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation.*
3	*Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems.*
4	*IIoT links the automation system with enterprise, planning and product lifecycle.*
5	*Real case studies*

COURSE OUTCOMES

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

CO1. Apply & Analyzing the transformation of industrial process by various techniques.	*Analyze*
CO2. Evaluate the transformation technologies are considered to be the different drivers.	*Apply*
CO3. Existing industrial systems will adopt the applications of IIoT.	*Apply*
CO4. Intensive contributions over automation system with enterprise, planning and product life cycle	*Analyze*
CO5. Analyze of various Real time 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	S	M	-	M	-	-	-	-	-	-	M	S	M	-
CO2	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO3	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO4	S	S	S	M	M	-	-	-	-	-	-	M	S	M	M
CO5	S	S	S	S	M	-	-	-	-	-	-	M	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO INDUSTRY 4.0 ANDINDUSTRIAL INTERNET OF THINGS*Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems, Cyber Physical Systems and Next Generation Sensors, Collaborative Platformand Product Lifecycle Management*

INDUSTRIAL INTERNET OF THINGS& IT'S LAYERS

Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation. IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II, Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II.

IIoT COMMUNICATION

Communication-Part I, Industrial IoT- Layers: IIoT Communication, IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT

IIoT BIG DATA & SDN APPLICATIONS
Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, and Industrial IoT- Application Domains. Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

APPLICATIONS & REAL TIME CASE STUDIES
Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies - Virtual reality lab, Manufacturing industries – part one, Manufacturing industries – part two, Milk processing and packaging industries, Steel technology lab, Student projects – part one, Student projects – part two

TEXT BOOKS:
1. *Anandarup Misra, Sudip | Roy, Chandana | Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0, CRC press, 2003.*

REFERENCE BOOKS:

1. *Gilchrist, Alasdair, "Introduction to IoT", Apress, 2016*
2. *Gilchrist, Alasdair "IIoT Reference Architecture", Apress, 2016*

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. L.K.Hema	Professor &Head	ECE	hodece@avit.ac.in
2	Dr.T.Muthumanickam	Professor& Head	ECE	hodece@vmkvec.edu.in

	3D PRINTING AND ITS APPLICATIONS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

Preamble

The course is designed to impart knowledge and skills related to 3D printing technologies its type applications.

Prerequisite – NIL

Course Objective

1	To Know the importance of 3D printing in Manufacturing
2	To know about Vat Photo Polymerization & Material Jetting.
3	To know about binder jetting material extrusion & sheet lamination
4	To know about the methods for powder bed fusion & direct energy deposition.
5	To know about the applications of 3D Printing.

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

CO1.	Importance of 3D printing in Manufacturing	Remember
CO2.	Vat Photo Polymerization & Material Jetting.	Understand
CO3.	Binder jetting material extrusion & sheet lamination	Understand
CO4.	Powder bed fusion & direct energy deposition.	Understand
CO5.	Applications of 3D Printing.	Understand

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	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO3	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO4	M	L	M	-	S	M	M	-	-	-	-	-	M	M-	M
CO5	M	L	L	-	-	-	-	-	-	-	-	-			

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION
Need - Development of AM systems – AM process chain -Classification of AM processes- Applications-Advantages of AM and Types of materials for AM.Introduction to STL format, Pre & Post-processing of STL files, Various slicing methods, Part orientation and support generation, Support structure design, Tool path generation
VAT PHOTO POLYMERIZATION & MATERIAL JETTING
Vat Photo polymerization - Stereo lithography process, working principle, advantages and disadvantages, Material Jetting - process, working principle, advantages and disadvantages.
BINDER JETTING-MATERIAL EXTRUSION & SHEET LAMINATION
Binder Jetting- process, working principle, advantages and disadvantages. Material Extrusion –Fused Deposition Modeling process, working principle, advantages and disadvantages. Sheet Lamination – Laminated Object Manufacturing process, working principle, advantages and disadvantages.
POWDER BED FUSION & DIRECT ENERGY DEPOSITION
Powder Bed Fusion – Selective Laser Sintering process, working principle, advantages and disadvantages, Direct Energy Deposition- process, working principle, advantages and disadvantages.
APPLICATIONS OF 3D PRINTING
Applications for 3D Printing - Use of 3D Printing-Limitations of 3D Printing and Further Development of Medical 3D Printing Applications. Use of Multiple Materials in 3D Printing-Embedded Component 3D Printing, Commercial Applications Using Multiple Materials, Future Directions, Business Opportunities and Future Directions.

Text Books	
1	Ian Gibson, David Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, New York, NY, 2015.
2	Venuvinod, Patri K., and Weiyin Ma. Rapid prototyping: laser-based and other technologies. Springer Science & Business Media, 2013.

Reference Books	
1	Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2003.
2	Ali K. Kamrani, Emand Abouel Nasr,"Rapid Prototyping: Theory & Practice", Springer, 2006.
3	Kumar, L. Jyothish, Pulak M. Pandey, and David Ian Wimpenny, eds. 3D printing and additive manufacturing technologies. Singapore: Springer, 2019.

Course Designers				
Sl.No	Faculty Name	Designation	Department/ Na me of the college	Email id
1	S.Kalyanakumar	Assistant Professor Gr II	Mech / AVIT	kalyanakumar@avit.ac.in

		Category	L	T	P	Credit
INDUSTRIAL ROBOTICS		**OE-EA**	**3**	**0**	**0**	**3**

Preamble

Theobjectiveofthiscourseistoimpartknowledgeaboutindustrialrobotsfortheircontrolanddesign.

Prerequisite :
NIL

CourseObjective

1	Tointroducebasicconcepts,partsofrobotsandtypesofrobots
2	TolearnaboutRobot kinematicsanddynamics
3	Tolearndifferent typesofsensorsusedinrobotsandisscontrol
4	Tounderstandthedifferenttypesofactuationsystemsusedinrobots
5	TounderstandtherobotcontrolSystems,programmingofrobotsanditsApplications.

CourseOutcomes:On thesuccessfulcompletionofthecourse,studentswillbeableto

CO1.	Understandthebasicconfigurationsandkinematicsystemsofrobots	Understand
CO2.	Solveproblemsofrobotkinematicsanddynamics	Apply
CO3.	Understandthedifferenttypesofsensorsusedinrobotsystemsandtheirapplications,different typesofcontrolsystemsused inrobots	Understand
CO4.	Understandandapplicationsofthedifferent types ofactuatorsusedin robot systems	Understand
CO5.	Understandthe RobotApplications in various fields	Understand

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTIONTOROBOTICS
Introduction to Automation and Robotics– Basic concepts, Need, Law, History, Anatomy, specificationsclassification, present and future applications. Components of the Industrial Robotics: common types of arms. Components, Architecture, degrees of freedom, Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response and Load Carrying Capacity.

ROBOT ARM KINEMATICS
Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation-Scaling, Rotation, Translation Homogeneous transformation. Control of robot manipulators – Point to point, Continuous Path Control

GRIPPERS AND SENSORS FOR ROBOTICS
Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics, Selections of sensors. Necessity for sensors and vision system in the working and control of a robot.

ROBOTACTUATIONSYSTEMS
Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison of Actuators, Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile and Range sensors, Force and Torque sensors – End Effectors and Tools

ROBOTAPPLICATIONS
Robot Application in Manufacturing: Material Transfer – Material handling, loading and unloading- Processing – spot and continuous arc welding & spray painting – Assembly and Inspection. ApplicationsinMedical, Household, Entertainment, Space, Underwater, Defense, Disaster management. Micro and Nano robots, Future Applications.

TextBooks	
1	Saha,S.K.,"IntroductiontoRobotics,2ndEdition,McGraw-HillHigherEducation,NewDelhi,2014.
2	MikellPGroover,NicholasGOdrey,MitchelWeiss,Roger NNagel,AshishDutta,"IndustrialRobotics, TechnologyprogrammingandApplications",McGrawHill,2012.
3	MittalR.K.andNagrathI.J.,"RoboticsandControl",TataMcGrawHill.

ReferenceBooks	
1	Ghosal, A.,"Robotics",Oxford, NewDelhi,2006.
2	NikuSaeedB.,"IntroductiontoRobotics:Analysis,Systems,Applications",PHI,NewDelhi.
3	SteveHeath,"EmbeddedSystemDesign",2ndEdition,Newnes,Burlington,2003
4	MerzoukiR.,SamantarayA.K.,PhathakP.M.andBouamamaB.Ould,"IntelligentMechatronicSystem:Modeling, ControlandDiagnosis",Springer.

CourseDesigners

S.No	FacultyName	Designation	Department/ Nameofthe College	Emailid
1	P.KUMARAN	AP-II	MECH/AVIT	kumaranp@avit.ac.in

	BIOMOLECULES - STRUCTURE, FUNCTION IN HEALTH AND DISEASE	Category	L	T	P	C
		OE-EA	3	0	0	3

PREAMBLE

Biomolecules like carbohydrates, proteins, fat are vital components of any living system. Basic knowledge about them helps in maintaining a healthy lifestyle, free of sickness and a general awareness about hygiene.

PREREQUISITE   NIL

COURSE OBJECTIVES

1	To give an overview of importance of biomolecules
2	To elaborate the structure of proteins and nucleic acids and its role in disease.
3	To enumerate the role of carbohydrates and their cellular function in physiology and pathology
4	To enumerate the role of lipids and their cellular function in physiology and pathology.
5	To briefly cholesterol and its role in diseases

COURSE OUTCOMES

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

CO1. Relate the basics of biomolecules in and around him	Understand
CO2. Understand the structure of biomolecules such as proteins and nucleic acids	Understand
CO3. Discover the role of carbohydrates in healthy and diseased conditions	Apply
CO4. Relate disfunctioning of lipids with disease	Analyse
CO5. Criticize the role of cholesterol in diseases.	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	L	-	-	L	-	-	-	-	-	-	-	L	-
CO2	S	M	S	-	-	M	-	-	-	-	-	-	-	L	-
CO3	M	L	M	M	-	S	-	-	-	-	-	-	-	L	-
CO4	L	L	L	L	S	L	-	-	S	-	-	M	L	M	M
CO5	S	-	L	L	-	M	-	-	-	-	-	S	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

PROTEINS

Protein – Structure – primary, secondary, tertiary. Types of proteins and their function. Role of each type of Protein in Health and Disease.

NUCLEIC ACIDS

Nucleic Acids – Components of nucleic acids, Conformational parameters. Nucleic acids – Types of DNA and RNA. DNA Polymorphism, Circular DNA, Supercoil DNA, DNA-Protein interactions. Role of nucelic acids in Health and disease

CARBOHYDRATES

Carbohydrates – Introduction. Types – monosaccharide, disaccharide, oligosaccharide and polysaccharides. Structure of each type. Artificial sugars. Role of carbohydrates in Health and Disease

FATTYACIDS AND LIPIDS

Fatty acids- Introduction, nomenclature, types - Saturated and unsaturated fatty acids, Essential and non-essential fatty acids.

Lipids – Introduction, Classification - simple and compound lipids, phospholipids, Cholesterol and its role in health and disease, Micelles and Liposomes : Applications in biology and medicine

CELL MEMBRANE AND CELL SIGNALING

Cell membrane - components and architecture, Various membrane models including Fluid-mosaic model. Ion channels, Receptors, Signaling molecules, Signaling mechanism, Role of cell signaling in Health and Disease. Inter-relationship of biomolecules.

TEXTBOOKS
1. Biophysical Chemistry, Part II, Techniques for the study of biological structure and function, by Cantor C.R. and Schimmel P R., W.H. Freeman and Company, 1980.

2. Nucleic Acids in chemistry and Biology, by Blackburn G.M. and gait M.J., IRL Press, 1990.

3. Biochemistry, by Voet D. and Voet J.G., John Wiley and sons, 1995.

4. Physical Biochemistry, by Freifelder D., W.H. Freeman and company, 1976-1982.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID

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2	Ms.S.Sowmiya	Assistant Professor	Pharmaceutical Engineering	sowmiya.vmkvec@vmrf.edu.in

	PHARMACOGENOMICS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Pharmacogenomics involves the study of the relationship between an individual's genetic makeup and his or her response to a drug. Pharmacogenetics, a component of pharmacogenomics, is the study of the relationship between a single gene and its response to a drug.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Discuss about the basic knowledge about pharmacogenomics and drug design using genomic applications for drug action and toxicity.
2	Perform how individualization of drug therapy can be achieved based on a person's genetic makeup while reducing unwanted drug effects.
3	Outline the Pharmacogenomics studies on how genetic differences between individuals can affect responses to various drugs.
4	Formulate on medicine skills acquired by the student and his action in different pathologies
5	Develop acquire knowledge about the influence of genetic alterations on the therapeutic effect and adverse reactions of the drugs, from a perspective of individualized therapy.

COURSE OUTCOMES

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

CO1.Recognize the effect of genetic differences between individuals in the outcome of drug therapy and in drug efficacy and toxicity.	Remember
CO2. Describe the role of single nucleotide polymorphism as a biomarker for the prediction of risk, therapeutic response and prognosis of malignancies.	Understand
CO3. Utilize and manage the new genomics based tools as they become available as well as make best treatment choices.	Understand
CO4. Examine the applications of genomics principles in drug action and toxicology	Analyze
CO5. Validation of case studies related to pharmacogenomics	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	L	L	L	L	-	L	L	L	L	L	L	
CO2	M	M	M	M	L	-	-	-	M	-	L	L	L	L	-
CO3	S	S	S	S	L	-	-	-	M	-	L	L	L	L	-

| CO4 | M | M | M | M | M | - | - | - | S | - | L | L | M | L | - |
| CO5 | L | L | L | L | S | - | - | - | M | - | M | M | S | M | - |

S- Strong; M-Medium; L-Low

SYLLABUS

PHARMACOGENOMICS AND PERSONALIZED MEDICINE

Pharmacogenetics - Roots of pharmacogenomics and it is not just pharmacogenomics, Genetic drug response profiles, the effect of drugs on Gene expression, pharmacogenomics in drug discovery and drug development. Concept of individualized drug therapy, Drivers and the promise of personalized medicine, Strategies for application of pharmacogenomics to customize therapy,Barriers.

HUMAN GENOME

Expressed sequence Tags (EST) and computational biology, Microbial genomics, computational analysis of whole genomes, computational genome analysis, Genomic differences that affect the outcome of host pathogen interactions, Protein coding genes, repeat elements, genome duplication, analysis of proteome, DNA variation, Biological complexity. Single nucleotide polymorphisms (SNP's) in Pharmacogenomics - approaches, number and types of SNPs, Study design for analysis, Analytical issues, Development of markers.

ASSOCIATION STUDIES IN PHARMACOGENOMICS

Viability and Adverse drug reaction in drug response, Multiple inherited genetic factors influence the outcome of drug treatments, Association studies in pharmacogenomics, Strategies for pharmacogenomics Association studies, Benefits of Pharmacogenomics in Drug R & D.

GENOMICS APPLICATIONS FOR DRUG ACTION, TOXICITY AND DESIGN

Platform technologies and Pharmaceutical process, its applications to the pharmaceutical industry, Understanding biology and diseases, Target identification and validation, Drug candidate identification and optimization, safety and toxicology studies. The need of protein structure information, protein structure and variation in drug targets-the scale of problem, Mutation of drug targets leading to change in the ligand binding pocket.

PHARMACOGENOMICS – CASE STUDIES

Study of pharmacogenomics of human P-Glycoprotein, drug transporters, lipid lowering drugs,

chemotherapeutic agents for cancer treatment.

TEXT BOOKS

1. Martin M. Zdanowicz, M.M. "Concepts in Pharmacogenomics" Second Edition, American Society of Health-System Pharmacists, 2017.
2. Licinio, J and Wong, Ma-Li. "Pharmacogenomics: The Search for the Individualized Therapies", Wiley-Blackwell, 2009.
3. Yan Q, "Pharmacogenomics in Drug Discovery and Development" Humana Press, 2nd Edition, 2014.

REFERENCES

1. Brazeau, D.A. and Brazeau, G.A. "Principles of the Human Genome and Pharmacogenomics" American Pharmacist Association, 2011
2. Werner, K., Meyer, U.A., Tyndale, R.F. "Pharmacogenomics", Second Edition, Taylor and Francis, 2005.
3. Langman, L.J. and Dasgupta, A. "Pharmacogenomics in Clinical Therapeutics", Wiley – Blackwell, 2012

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Ms. R. Jaishri	Assistant Professor	Pharmaceutical Engineering	jaishri@vmkvec.edu.in

	PROJECT WORK	Category	L	T	P	Credit
		PI-P	0	0	16	8

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	Evaluate

communication skills.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R.Devarajan	Professor	EEE/VMKVEC	deverajan@vmkvec.edu.in
2	Dr. L.Chitra	Asso. Prof.	EEE/AVIT	chitra@avit.ac.in

Course Code	Course Title	Category	L	T	P	C
	YOGA AND MEDITATION	AC	0	0	2	0

OBJECTIVES:

Yoga is derived from a Sanskrit word 'yuj' which loosely means 'union.' It is a path through which an individual unites with the entire existence. Sounds heavy, right? It basically means how you are not a separate entity but part of a greater energy. It increases your consciousness and makes you realize your true self-clearing the clutter of all that you imbibed as part of your culture, family, and education. It makes you realize that there is something more than what you see around. It is a deeply spiritual practice that is part philosophy, religion, science, and exercise.

COURSE CONTENT
- Surya namaskar,Padmasana, Uttakatasana
- Surya pranayama, BrahmariPranayama
- Anjalimudra, Mahamudra, Chin Mudra
- Kapalabathikriya,Bhastrika, Tratakkriya
- Simple Meditation,YogaBreath awareness meditation,.

OUTCOMES :
- It incorporates breathing exercises, meditation and poses designed to encourage relaxation and reduce stress.
- Practicing yoga is said to come with many benefits for both mental and physical health.
- Yoga is known for its ability to ease stress and promote relaxation.
- Many people begin practicing yoga as a way to cope with feelings of anxiety.
- Could Improve Heart Health
- Improves Quality of Life.
- Could Promote Sleep Quality.
- Improves Flexibility and Balance.
- Could Help Improve Breathing.
- Promotes Healthy Eating Habits.
- Can Increase Strength.

TEXT BOOK:
YogacharyaSundaram, *Sundra Yoga Therapy*, Asana Publications, 2009

REFERENCES:
1. Dr.V.Krishnamoorthy, *Simple Yoga for Health*, Sri MathiNilayam, 2012.
2. Dr.AnandaBalayogiBhavanani, *A Primer of Yoga Theory*, Dhivyananda Creations,2008.
3. Dr.S.Hema, Easy *Yoga for Beginners*, Tara yoga Publications,2008.
4. Dr.AsanaAndiappan, *Ashtanga Yoga*, Asana Publications, 2009.
5. Dr.JohnB.Nayagam, *MudumaikkuMutrupulliVaikkumMuthiraigal*, SaaruPrabha Publications, 2010.

Subject Code	Gender Equity and Law (Common to all Branches)	Category	L	T	P	Credit
_____		AC	0	0	2	0

Gender Equity is the provision of fairness and justice in the distribution of benefits and responsibilities between Men, Women, Transgender, and Gender non-binary individuals. Gender equity is important because, historically, societies around the world have deemed females, transgender people, and nonbinary people as "weaker" or less important than males. Gender equity emphasizes respecting individuals without discrimination, regardless of their gender. There are legal provisions thataddress issues like inequalities that limit a person's ability to access opportunities to achieve better health, education, and economic opportunity based on their gender.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	To sensitize the students regarding the issues of gender and thegender inequalities prevalent in society.
2	To raise and develop social consciousness about gender equity among thestudents.
3	To build a dialogueand bring a fresh perspective on transgender and gender non-conforming individuals.
4	To create awareness among the students and to help them face gender stereotype issues.
5	To help the studentsunderstand the various legal provisions that are available in our society.

COURSE OUTCOMES

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

CO1.Understand the importance of gender equity	Understand
CO2.Initiate the awareness and recognize the social responsibility with regards to gender equity.	Apply
CO3.To develop a sense of inclusiveness and tolerance towards various genders without any discrimination.	Apply
CO4. To evaluate the social issues and apply suitable gender-related regulations for inclusive living.	Evaluate
CO5.To identify and analyze the existing gender inequality problems faced in various institutions.	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	S	M	L	-	-	S	S	S	-	-	-	S	-	-	-
CO2	S	M	M	-	-	S	S	S	-	-	-	S	-	-	-
CO3	S	L	M	-	-	S	S	S	-	-	-	S	-	-	-
CO4	S	S	S	L	-	S	S	S	-	-	-	S	-	-	-
CO5	S	S	S	M	-	S	S	S	-	-	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT –I INTRODUCTION TO GENDER AND SEX

6hrs

Definition of Sex – Definition of Gender - Sex Vs. Gender - Social Construction of Gender and Gender Roles – GenderStereotypes - Gender Division of Labour - Patriarchy, Masculinity and Gender Equality -Feminism and Patriarchy.

UNIT –II - GENDER BIAS

6 hrs

Introduction to Gender Inequality in India - Gender Bias in Media - Misleading Advertisement And
Poor Portrayal of Women and gender non-conforming individuals- Objectification of Women, Transgender, and gender non-conforming individuals - Differential Treatment of Women, Transgender, Exploitation Caused by Gender Ideology - Female Infanticide - Honor Killing.

UNIT –III GENDER SENSITIZATION AND INTERNATIONAL CONVENTIONS **6 hrs**

Gender Sensitization -Need and Objective - Gender Sensitivity Training at Workplace – GenderSensitization in Judiciary - Gender Sensitization in School Curriculum.

UNIT-IV - SEXUAL OFFENCES AGAINST WOMEN **6 hrs**

Indian Penal Code, 1860 - S., 304B, 354, 354C, 354d, 376, 498A & 509 - The ImmoralTrafficPrevention Act 1986 - The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 - Protection of Women from Domestic Violence Act, 2005- Indecent Representation of Women Act, 1986**.**

UNIT-V ROLE OF GOVERNMENT FOR INCLUSIVE DEVELOPMENT

6hrs

Initiatives of NCERT -Role of Ministry of Women and Child Development - Governmental Initiatives: Beti BachaoBeti Padhao (BBBP) - Ujjawala Scheme - Working Women Hostels (WWH), National Council for Transgender Persons.

TEXT BOOKS

1. IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU
2. Jane Pilcher and Imelda Whelehan (2005): Fifty Key Concepts in Gender Studies

REFERENCES:

1. Women's Empowerment & Gender Parity: @Gender Sensitization, Dr. Shikha Bhatnagar, Repro Books (2020).

2. Gender Sensitization: Issues and Challenges, Anupama Sihag Raj Pal Singh, Raj Publications (2019).

3. Violence Against Women: Current Theory and Practice in Domestic Abuse, Sexual Violence, andExploitation (Research Highlights in Social Work), Jessica Kingsley Publishers (2012).

4. Gill, Rajesh, Contemporary Indian Urban Society- Ethnicity, Gender and Governance, BookwellPublishers, New Delhi (2009).

5. Sexual Violence Against Women: Penal Law and Human Rights Perspectives, Lexis Nexis (2009) 6. Chatterjee, Mohini, Feminism and Gender Equality, Aavishkar, Jaipur,2005.

7. Mies, Maria, Indian Women and Patriarchy, Concept Publishing Company, New Delhi, 2004.

COURSE DESIGNERS		
S.No.	Name of the Faculty	Mail ID
1	Gnana Sanga Mithra.S	sangamithra@avil.edu.in
2	Aarthy.G	aarthy@avil.edu.in

Course Code	Course Title	Category	L	T	P	C
	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE					
		AC	0	0	2	0

Course Objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes:

At the end of the Course, Student will be able to:

1. Identify the concept of Traditional knowledge and its importance.
2. Explain the need and importance of protecting traditional knowledge.
3. Illustrate the various enactments related to the protection of traditional knowledge.
4. Interpret the concepts of Intellectual property to protect the traditional knowledge.
5. Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT-I:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

UNIT-2:

Protection of traditional knowledge: The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT-3:

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

UNIT-4:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

UNIT-5:

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation

and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Text Books:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

Reference Books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

Web Links:

1.https://www.youtube.com/watch?v=LZP1StpYEPM

Course Code	Course Title	category	L	T	P	C
	INDIAN CONSTITUTION	AC	0	0	2	0

Course Objectives:
On completion of this course, the students will be able:
 1 To understand the nature and the Philosophy of the Constitution.
2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.
 3 To Analyse Panchayat Raj institutions as a tool of decentralization.
4 To Understand and analyse the three wings of the state in the contemporary scenario.
5 To Analyse Role of Adjudicatory Process.
 5 To Understand and Evaluate the recent trends in the Indian Judiciary.
Course Content
UNIT I
The Constitution - Introduction
 The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure **-** Fundamental Rights and Fundamental Duties –Directive Principles State Policy
UNIT II –Government of the Union
The Union Executive**-** Powers and duties of President –Prime Minister and Council of Ministers **-** Lok Sabha and Rajya Sabha
UNIT III –Government of the States
The Governor –Role and Powers **-** Cheif Minister and Council of Ministers**-** State Legislature
UNIT IV – Local Government
 The New system of Panchayat, Municipalities and Co-Operative Societies
UNIT V – Elections
Powers of Legislature **-**Role of Chief Election Commissioner**-**State Election Commission
TEXTBOOKS AND REFERENCE BOOKS:
1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition Suggested.
Total Hours: 30 hours
Software/Learning Websites:
 1. https://www.constitution.org/cons/india/const.html
2. http://www.legislative.gov.in/constitution-of-india
3. https://www.sci.gov.in/constitution
4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of india/
Alternative NPTEL/SWAYAM Course:

S.NO	NPTEL ID	NPTEL Course Title	Course Instructor
1	12910600	CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS	PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

COURSE DESIGNER				
S.NO	NAME OF THE FACULTY	DESIGNATION	NAME OF THE INSTITUTION	MAIL ID
1	Dr.Sudheer	Professor	AV School of Law	Sudheersurya18@gmail.com