VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

Faculty of Engineering and Technology

Programme : B.E – Mechanical Engineering – Part Time

Choice Based Credit System (CBCS)

Curriculum & Syllabus (Semester I to VII)

Regulations 2021

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

Board of Mechanical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO.1	Design, analyze & fabricate, maintain and improve mechanical engineering systems that are technically sound, economically feasible and socially acceptable to enhance quality of life.
PEO.2	Apply modern computational, analytical, simulation tools and techniques to address the challenges faced in mechanical and allied engineering streams.
PEO.3	Communicate effectively using innovative tools and demonstrate leadership & entrepreneurial skills.
PEO.4	Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning to achieve career and organizational goals.

PROGRAM SPECIFIC OUTCOMES (PSOs)

To achieve the mission of the program, Mechanical Engineering graduates will be able:

PSO.1	To work independently as well as in team to formulate, design, execute solutions for engineering problems and also analyze, synthesize technical data for application to product, process, system design & development
PSO.2	To understand & contribute towards social, environmental issues, following professional ethics and codes of conduct and embrace lifelong learning for continuous improvement
PSO.3	To develop expertise towards use of modern engineering tools, careers in industries and research and demonstrate entrepreneurial skill

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.

Credit Requirement for Course Categories

S.No.	Category of Courses	Types of Courses	Suggested Breakup of Credits (Min – Max)
A	***Foundation Courses***		12 - 18
(a)	Humanities and Social Sciences including Management Courses		6 - 9
(b)	Basic Science Courses (Maths, Physics & Chemistry)		6 -9
B	**Professional - Program Core courses (PCC)**		61
C	**Elective Courses (EC)**		18
(a)	Professional Electives (Classroom /Online)		12-15
(b)	Open Elective (Classroom /Online) Innovation, Entrepreneurship, Skill Development, Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc.		3 - 9
D	**Project Work**		10
	Minimum Credits to be earned		**107**

A. Foundation Courses (FC) – (12-18)

i. Humanities and Sciences (English and Management Courses)- (6-9)

S.No	Course Code	Course Name	Offering Dept	Category	L	T	P	C	Prerequisite
1		Technical English	English		**3**	**0**	**0**	**3**	
2		English Language Lab	English		**0**	**0**	**4**	**2**	
3		Business English	English		**3**	**0**	**0**	**3**	
4		Total Quality Management	Mgt		**3**	**0**	**0**	**3**	
5		Engineering Management and Ethics	Mgt		**3**	**0**	**0**	**3**	
6		Universal Human Values – Understanding Harmony	English		**3**	**0**	**0**	**3**	

ii. Basic Sciences (Maths, Physics and Chemistry Courses) –(6-9)

S.No	Course Code	Course Name	Offering Dept	Category	L	T	P	C	Prerequisite
1		Engineering Mathematics	Maths		**2**	**1**	**0**	**3**	
2		Physical Sciences	Physics & Chemistry		**4**	**0**	**0**	**4**	
3		Smart Materials	Physics		**3**	**0**	**0**	**3**	
4		Physical Sciences Lab	Physics & Chemistry		**0**	**0**	**4**	**2**	
5		Industrial Materials	Chemistry		**3**	**0**	**0**	**3**	
6		Mathematics For Mechanical Sciences	Maths		**2**	**1**	**0**	**3**	Engineering Mathematics
7		Numerical Methods For Mechanical Sciences	Maths		**2**	**1**	**0**	**3**	Engineering Mathematics & Mathematics For Mechanical Sciences
8		Resource Management Technique	Maths		**2**	**1**	**0**	**3**	
9		Probability And Statistics	Maths		**2**	**1**	**0**	**3**	

B. Core courses (CC) – (61)									
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**	**Prerequisite**
1		Manufacturing Processes - **NPTEL**	Mech		**3**	**0**	**2**	**4**	
2		Fluid Mechanics and Machinery	Mech		**2**	**1**	**2**	**4**	
3		Mechanics of Machines - **NPTEL**	Mech		**3**	**0**	**2**	**4**	Engineering Mechanics
4		Mechanical Behaviour of Materials And Metallurgy- **NPTEL**	Mech		**3**	**0**	**2**	**4**	
5		Strength of Materials- **NPTEL**	Mech		**2**	**1**	**2**	**4**	Engineering Mechanics
6		Engineering Thermodynamics- **NPTEL**	Mech		**2**	**1**	**2**	**4**	
7		Thermal Engineering Sciences	Mech		**2**	**1**	**2**	**4**	Engineering Thermodynamics
8		Design of Machine Elements	Mech		**2**	**1**	**0**	**3**	
9		Engineering Metrology and Measurements- **NPTEL**	Mech		**3**	**0**	**2**	**4**	
10		Automobile Engineering- **NPTEL**	Mech		**3**	**0**	**2**	**4**	
11		Computer Integrated Manufacturing- **NPTEL**	Mech		**3**	**0**	**2**	**4**	Manufacturing Processes
12		Design of Transmission System	Mech		**2**	**1**	**0**	**3**	
13		Heat and Mass Transfer- **NPTEL**	Mech		**2**	**1**	**2**	**4**	Thermal Engineering Sciences
14		Finite Element Analysis- **NPTEL**	Mech		**3**	**0**	**2**	**4**	Computer Integrated Manufacturing
15		Gas Dynamics and Jet Propulsion	Mech		**3**	**1**	**0**	**4**	
16		Engineering Mechanics (Statics & Dynamics)	Mech		**2**	**1**	**0**	**3**	
								61	

C. Elective Courses (EC)

i. Professional Electives – (12-15)

S.No	Course Code	Course Name	Offering Dept	Category	L	T	P	C	Prerequisite
1		Powder Metallurgy	Mech		**3**	**0**	**0**	**3**	
2		Additive Manufacturing in Medical Applications	Mech		**3**	**0**	**0**	**3**	
3		Rapid Tooling And Industrial Applications	Mech		**3**	**0**	**0**	**3**	
4		Polymer Engineering	Mech		**3**	**0**	**0**	**3**	
5		3D Printing and Design	Mech		**3**	**0**	**0**	**3**	
6		Integrated Product Design & Development	Mech		**3**	**0**	**0**	**3**	
7		Manufacturing Control & Automation	Mech		**3**	**0**	**0**	**3**	
8		Robotics Based Industrial Automation	Mech		**3**	**0**	**0**	**3**	
9		Automation in Manufacturing	Mech		**3**	**0**	**0**	**3**	
10		Product Design For Manufacturing and Assembly	Mech		**3**	**0**	**0**	**3**	
11		Automotive Chassis	Mech		**3**	**0**	**0**	**3**	
12		Vehicle Transport Management	Mech		**3**	**0**	**0**	**3**	
13		Engine And Vehicle Management System	Mech		**3**	**0**	**0**	**3**	
14		Vehicle Maintenance	Mech		**3**	**0**	**0**	**3**	
15		Automotive Electrical and Electronic Systems	Mech		**3**	**0**	**0**	**3**	
16		Energy Conservation in Thermal Systems	Mech		**3**	**0**	**0**	**3**	
17		Hydrogen and Fuel Cell Technology	Mech		**3**	**0**	**0**	**3**	
18		Renewable Sources of Energy	Mech		**3**	**0**	**0**	**3**	
19		Waste Energy Conversion Technologies	Mech		**3**	**0**	**0**	**3**	
20		Combustion Engineering	Mech		**3**	**0**	**0**	**3**	
21		Computational Fluid Dynamics	Mech		**3**	**0**	**0**	**3**	
22		Cryogenic Engineering	Mech		**3**	**0**	**0**	**3**	
23		Power Plant Engineering	Mech		**3**	**0**	**0**	**3**	
24		Refrigeration And Air- Conditioning	Mech		**3**	**0**	**0**	**3**	
25		Turbo Machinery	Mech		**3**	**0**	**0**	**3**	
26		Design of Thermal Power Equipments	Mech		**3**	**0**	**0**	**3**	
27		Heat Exchangers – Fundamentals and design analysis	Mech		**3**	**0**	**0**	**3**	

ii. Open Electives - (3- 9)

a. Innovation, Entrepreneurship, Skill Development etc.

S.No	Course Code	Course Name	Offering Dept	Category	L	T	P	C	Prerequisite
1		Engineering Startups and Entrepreneurial Management	Mgt		**3**	**0**	**0**	**3**	
2		Project Management for Engineering Business and Technology	Mgt		**3**	**0**	**0**	**3**	
3		Intellectual Property Rights & Alternate Disputes Resolutions	Mgt		**3**	**0**	**0**	**3**	
4		Innovation, Product Development And Commercialization	Mgt		**3**	**0**	**0**	**3**	
5		Social Entrepreneurship	Mgt		**3**	**0**	**0**	**3**	
6		New Venture Planning and Management	Mgt		**3**	**0**	**0**	**3**	

b. Emerging Areas like 3D Printing, Artificial Intelligence, Internet of Things etc.

S.No	Course Code	Course Name	Offering Dept	Category	L	T	P	C	Prerequisite
1		Disaster Mitigation and Management	Civil		**3**	**0**	**0**	**3**	
2		Municipal Solid and Waste Management	Civil		**3**	**0**	**0**	**3**	
3		Introduction to Internet of Things	CSE		**3**	**0**	**0**	**3**	
4		Fundamentals of Artificial Intelligence	CSE		**3**	**0**	**0**	**3**	
5		Robotics And Automation	ECE		**3**	**0**	**0**	**3**	
6		Introduction to Industry 4.0 And Industrial Internet of Things	ECE		**3**	**0**	**0**	**3**	
7		Green Power Generation Systems	EEE		**3**	**0**	**0**	**3**	
8		Industrial Drives And Automation	EEE		**3**	**0**	**0**	**3**	
9		Bioterrorism and National Security	BTE		**3**	**0**	**0**	**3**	
10		Food And Nutrition Technology	BTE		**3**	**0**	**0**	**3**	
11		Biomolecules : Structure, Function In Health And Disease	PCE		**3**	**0**	**0**	**3**	
12		Pharmacogenomics	PCE		**3**	**0**	**0**	**3**	

D. Project Work									
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**	**Prerequisite**
1		Project work	Mech		**0**	**0**	**20**	**10**	

HUMANITIES AND SCIENCES COURSES

HUMANITIES AND SCIENCES COURSES

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

Preamble

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

Prerequisite : NIL

Course Objective

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

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO COMMUNICATION

Self introduction –understanding SWOT and SOAR, Simulations using E Materials - Whatsapp, Face book, Hiker, Twitter- Effective Communication with Minimum Words - Listening Skills- Passive and Active listening, Listening to Native Speakers - Characteristics of a good listener.

GRAMMAR AND VOCABULARY

Identify the different Parts of Speech- Word formation with prefixes and suffixes -Common Errors in English - Scientific Vocabulary (definition and meaning)– Technical Abbreviations and Acronyms , Sentence Pattern (SVOCA) ,Tense forms , Conditional Sentences, Impersonal Passive Voice, Articles - Phonetics (Vowels, Consonants and Diphthongs) - Pronunciation Guidelines -Listening to Indian speakers from different regions, intrusion of mother tongue - Homophones – Homonyms - Note taking and Note making

SPEAKING SKILLS

Verbal and Non verbal Communication - Describing objects - Process Description- Interpretation of Images

and Films Speaking Practice - Telephone Etiquettes - Telephonic conversation with dialogue- Interpersonal Skills.

READING SKILLS

Reading for information- Technical articles, News Letters and Editing - Skimming- Scanning - How to Improve Reading Speed – Technical Jargons

TECHNICAL WRITING

Types of paragraphs -- Technical and Non technical Report Writing/ Proposal (Attend a technical seminar and submit a report) Transcoding (Flow Chart, Bar Chart and Pie Chart) – Informal and Formal letters – Application letter- Resume Writing- Difference among Bio data, Resume and Curriculum Vitae, Digital resume Techniques, Statement of Purpose (SOP), Proof reading

Text Books

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

Reference Books

1. English for Effective Communication, Department of English, VMKV & AVIT, SCM Publishers, 2009.
2. Practical English Usage- Michael Swan (III edition), Oxford University Press
3. Grammar Builder- I, II, III, and Cambridge University Press.
4. Pickett and Laster. Technical English: Writing, Reading and Speaking, New York: Harper and Row Publications, 2002.

Alternative NPTEL/SWAYAM Course – Nil

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	-	-	-	-

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr. Jennifer G Joseph	Professor & Head	English /AVIT	jennifer@avit.ac.in
2	Dr. P.Saradha	Associate Professor	English /VMKVEC	saradhap@vmkvec.edu.in

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

Preamble

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

Prerequisite : NIL

Course Objective

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

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

CO1.	Give best performance in group discussion and interview	Understand
CO2.	Best performance in the art of conversation and public speaking.	Apply
CO3.	Give better job opportunities in corporate companies.	Apply
CO4.	Better understanding of nuances of English language through audio-visual experience and group activities.	Apply
CO5.	Speaking skills with clarity and confidence which in turn enhances their employability skills	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

MODULE I

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

MODULE II

Influence of mother tongue, videos, understanding nuances of English language (video) puzzle to solve, Activity. Interpreting and Analysing a research article - Approaches to Review Paper Writing - Structure of a research article - Referencing

MODULE III

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

MODULE IV

Telephone Etiquette, Dining Etiquette, Meeting Etiquette, Corporate Etiquette, Business Etiquette.
MODULE V
Case study of Etiquette in different scenario
Alternative NPTEL/SWAYAM Course – Nil

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	-	-	-	-

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr. Jennifer G Joseph	Professor & Head	English /AVIT	jennifer@avit.ac.in
2	Dr. P.Saradha	Associate Professor	English /VMKVEC	saradhap@vmkvec.edu.in

	BUSINESS ENGLISH	Category	L	T	P	Credit
		HSS	3	0	0	3

Preamble

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

Prerequisite : NIL

Course Objective

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

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

CO1.	Communicate with a range of formal and informal context	Understand
CO2.	Demonstrate interaction skills and consider how own communication is adjusted in different scenario.	Apply
CO3.	Use strengthened oral and written skills in the business context.	Apply
CO4.	Create interest in a topic by exploring thoughts and ideas.	Apply
CO5.	Have better performance in the art of communication	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF LANGUAGE AND LISTENING SKILLS

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

SPEAKING SKILLS

Stress (Word Stress and Sentence Stress) Intonation- Difference between British and American English Vocabulary-Indianism-Compound Words (including Technical Terminology) Jargons- Technical and Business, Listening to TED Talks and discussion on the topic heard

READING SKILLS

Extempore**,** , Speaking activities- pair and group designed by the faculty, Group Discussion-Types of Interviews, Watching Documentary Films and Responding to Questions, Reading Skills-Skimming, Scanning, Understanding Ideas and making Inferences-– FAQs –,Critical Reading-Book Review-Finding Key Information and Shifting Facts from Opinions, reading for pleasure (motivational, short novels, classical etc)

CORPORATE COMMUNICATION

What is Corporate Communication? Types of Office communications -Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers , Technical Articles – Written communication Project Proposals- E - Mail Netiquette - Sample E – mails Making Presentations on given Topics -Preparing Power Point Presentations-Business Letters (Calling for Quotation, Placing Orders and Complaint Letters)

Text Books

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

Reference Books

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

Alternative NPTEL/SWAYAM Course – Nil

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	-	-	-	-

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
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2	Dr. P.Saradha	Associate Professor	English /VMKVEC	saradhap@vmkvec.edu.in

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

PREAMBLE:

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

PREREQUISITE: 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
		HSS	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

	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY	Category	L	T	P	C
		HSS	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

BASIC SCIENCES COURSES

BASIC SCIENCES COURSES

	ENGINEERING MATHEMATICS	Category	L	T	P	Credit
		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 Objective

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

CO	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).

Reference Books

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).

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	Nil			

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr. A.K.Bhuvaneswari	Assistant Professor	Mathematics/AVIT	bhuvaneswari@avit.ac.in
2	Dr.G.Selvam	Associate Professor	Mathematics/VMKVEC	selvam@vmkvec.edu.in

	PHYSICAL SCIENCES PART A - ENGINEERING PHYSICS	Category	L	T	P	Credit
		Basic Sciencs	2	0	0	2

PREAMBLE

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

PREREQUISITE : NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	S		M									M	M		M
CO2	S		L									M	M		
CO3	S			M			M					M	M		
CO4	S	M		M	M	S	M					M	S		M
CO5	S	M	M									M	M		

S- Strong; M-Medium; L-Low

SYLLABUS

LASERS: Laser characteristics - Stimulated Emission – Population Inversion - Einstein coefficients – Lasing action – Types of Laser – Nd:YAG laser, CO2 laser, GaAs laser – Applications of Laser – Holography – construction and reconstruction of a hologram.

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

ULTRASONICS: Ultrasonic production: Magnetostriction and piezo electric methods – Determination of velocity of ultrasonic waves (acoustic grating) – Applications of ultrasonics

TEXT BOOK

1. Engineering Physics, compiled by Department of Physics, Vinayaka Mission's Research Foundation (Deemed to be University), Salem.
2. Palanisamy P. K., Engineering Physics, Scientific Publishers, 2011.
3. Avadhanulu M. N., Kshirsagar P. G., Arun Murthy T. V. S., A Textbook of Engineering Physics, S. Chand Publishing, 2018.

REFERENCE BOOKS

1. Beiser, Arthur, Concepts of Modern Physics, 5th Edition, McGraw-Hill, 2009.
2. Halliday.D, Resnick.R, Walker.J, Fundamentals of Physics, Wiley & sons, 2013.
3. Gaur R. K. and Gupta S. L., Engineering Physics, DhanpatRai publishers, New Delhi, 2012.
4. Srivastava S. K., Laser Systems and Applications 3rd Edition, New Age International (P) Ltd Publishers, 2019.
5. Ajoy Ghatak, Thyagarajan K., Introduction To Fiber Optics, Cambridge India, 2013.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. SENTHIL KUMAR	PROFESSOR	PHYSICS	senthilkumarc@vmkvec.edu.in
2	Dr. R. SETHUPATHI	ASSOCIATE PROFESSSOR	PHYSICS	sethupathi@vmkvec.edu.in

	PHYSICAL SCIENCES PART-B - ENGINEERING CHEMISTRY (Common to all Branches)	Category	L	T	P	Credit
		BS	2	0	0	2

Preamble

The objective of this course is to better understand the basic concepts of chemistry and its applications in diverse engineering domains. It also imparts knowledge on the properties of water and its treatment methods, Electrochemistry, corrosion and batteries, properties of fuel and combustion. This course also provides an idea to select the material for various engineering applications and their characterization.

Prerequisite : NIL

Course Objective

1	To Provide the knowledge on water treatment.
2	To explain about the importance of electrochemistry, mechanism of different corrosion and principle and working of batteries.
3	To explain different types of fuel, properties and its important features.

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

CO1	Estimate the hardness of water Apply and Identify suitable water treatment methods.	Apply
CO2	Describe terms involved in electrochemistry, the control methods of corrosion and working of energy storage devices.	Analyze
CO3	Understand the quality of fuels from its properties and the important features of fuels	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

WATER TECHNOLOGY

Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA. Boiler troubles - Treatment of boiler feed water – Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning). External treatment – Ion exchange process, zeolite process – Domestic water treatment - desalination of brackish water – Reverse Osmosis and Electrodialysis.

ELECTROCHEMISTRY, CORROSION AND BATTERIES

Electrochemistry: Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass) - Galvanic cell- Electrochemical cell representation - EMF series and its significance. Corrosion – Definition causes and effects, Classification, Types of corrosion- dry corrosion, Wet corrosion, Factors influencing rate of corrosion, Corrosion control methods – Sacrificial anode method and impressed

current cathodic method.

Batteries: Terminology- Daniel cell – Dry cell - Lead-acid accumulator- Nickel-Cadmium batteries, Lithium batteries: Li/SOCl2 cell - Li/I2 cell- Lithium ion batteries. Fuel cells: Hydrogen-oxygen fuel cell, Solid oxide fuel cell (SOFC)

FUELS AND COMBUSTION

Fuels: Introduction – classification of fuels – coal – analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – petroleum – manufacture of synthetic petrol (Bergius process). Knocking – octane number – cetane number – natural gas – compressed natural gas (CNG). Liquefied petroleum gases (LPG) – power alcohol and biodiesel. Combustion of fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – ignition temperature – spontaneous ignition temperature – explosive range – flue gas analysis (ORSAT Method).

Text Books

1. Engineering Chemistry by Jain and Jain, 16th Edition, Dhanpat Rai Publishing Company, New Delhi, 2017
2. A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi
3. A text book of Engineering Chemistry by Shashi Chawla, Edition 2012 Dhanpatrai & Co., New Delhi.

Reference Books

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane, 3rd Edition, McGraw Hill, 1980
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins, Julio de Paula, 8th Edition, Oxford University press, 2007
Engineering Chemistry by Dr. A. Ravikrishnan, Sri Krishna Publications, Chennai.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	**Dr. A.R. Sasieekhumar**	Assistant Professor	CHEM/ VMKVEC	**sasieekhumar@vmkvec.edu.in**
2	**Dr. R. Nagalakshmi**	Professor	CHEM/ AVIT	**nagalakshmi.chemistry@avit.ac.in**

	SMART MATERIALS	CATEGORY	L	T	P	C
		Basic Sciences	3	0	0	3

PREAMBLE

Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Properties of Crystalline Materials, Smart Materials and Nanomaterials, and their industrial applications, characteristics and industrial applications of Magnetic and Superconducting materials.

PREREQUISITE : Physical Sciences

COURSE OBJECTIVES:

1	To impart the basic properties of different materials.
2	To understand the structure of crystalline materials.
3	To understand the properties of smart materials and realize its industrial applications.
4	To learn the synthesis of Nano materials and carbon nanotubes.
5	To learn the properties, classification and relevant applications of magnetic materials.
6	To understand the concept of superconductivity, properties of super conductor and their industrial applications.

COURSE OUTCOMES:

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

CO1. Understand the basic properties of various materials.	Understand
CO2. Learn the structure of Crystalline Materials	Apply
CO3. Gain the basic knowledge and recognize the applications of Smart Materials	Apply
CO4. Get an exposure about the properties of Nano materials	Apply
CO5. Gain the knowledge about the properties of magnetic materials and familiarize their applications.	Apply
CO6. Gain the knowledge about Superconducting materials	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	POS 1	POS 2	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

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

SMART MATERIALS: Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application – SMA in Actuators and Blood clot filters, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and industrial applications (Core of the Transformer).

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

MAGNETIC MATERIALS: Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials – Applications of Magnetic materials (Magnets in Generators and MRI scan).

SUPER CONDUCTING MATERIALS: Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Industrial Applications of superconductors (SQUID, Cryotrons and Maglev Trains).

TEXT BOOKS

1. Palanisamy P.K. Materials Science. SCITECH Publishers, 2015.
2. A.K. Katiyar and C.K. Pandey, Engineering Physics Theory and Practical, Wiley Publisher, 2015.

REFERENCES

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.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr. G. Suresh	Associate Professor	Physics	suresh.physics@avit.ac.in
2.	Dr. R. N. Viswanath	Professor	Physics	rnvishwanath@avit.ac.in
3.	Dr. B. Dhanalakshmi	Associate Professor	Physics	dhanalakshmi.phys@avit.ac.in

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

PREAMBLE

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

PREREQUISITE

NIL

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

CO1. Recognize the importance of units while performing the experiments, calculating the physical parameters and obtaining results	Understand
CO2. Operate the equipments with precision	Apply
CO3. Practice to handle the equipments in a systematic manner	Apply
CO4. Demonstrate the experiments through virtual laboratory	Apply
CO5. Calculate the result with accuracy	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser
6. Wavelength of spectral lines – grating – Spectrometer
7. Thickness of a wire - Air wedge Method

8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

LAB MANUAL

Physical Sciences Lab: Part A – Real And Virtual Lab In Physics Manual compiled by Department of Physics, Vinayaka Mission's Research Foundation (Deemed to be University), Salem.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. SENTHIL KUMAR	PROFESSOR	PHYSICS	senthilkumarc@vmkvec.edu.in
2	Dr. R. SETHUPATHI	ASSOCIATE PROFESSSOR	PHYSICS	sethupathi@vmkvec.edu.in

	PHYSICAL SCIENCES PART-B - ENGINEERING CHEMISTRY LAB (Common to all Branches)	Category	L	T	P	Credit
		BS	0	0	2	1

Preamble

Engineering Chemistry Lab experiments explains the basics and essentials of Engineering Chemistry. It also helps the students to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives clear basic application oriented knowledge about electrochemistry. Water technology study gives the idea about hardness and its disadvantages. Now-a-days the practical and handling of equipments are needed for our fast growing life style.

Prerequisite : NIL

Course Objective

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

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

CO1	Understand the basic skills for his/her future studies.	Understand
CO2	Analyze the water comprehensively.	Apply
CO3	Apply the practical knowledge in engineering aspects	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of Hardness by EDTA method
2. Estimation of Hydrochloric acid by conductometric method
3. Acid Base titration by pH method
4. Estimation of Ferrous ion by Potentiometric method
5. Determination of Dissolved oxygen by Winkler's method
6. Estimation of Sodium by Flame photometer
7. Estimation of Copper from Copper Ore Solution
8. Estimation of Iron by Spectrophotometer

Text Books

1. Engineering Chemistry Lab Manual by VMU. Delhi.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	**Dr. R. Nagalakshmi**	Professor	CHEM/ AVIT	**nagalakshmi.chemistry @avit.ac.in**
2	A. Gilbert Sunderraj	Assistant Professor	CHEM/ VMKVEC	gilbertsunderraj@vmkvec. edu.in

	INDUSTRIAL MATERIALS	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble:
Industrial Material is a part of the long chain in the design and manufacturing process. It deals with the ideas, the design, the testing, and prototyping of new industrial products. To solve the major problems of the world and their essential skills are, in-depth knowledge and application of chemistry and creativity with chemicals.

Prerequisite : NIL

Course Objective

1	To Describe the various metallic materials.
2	To Apply the various smart materials for industries.
3	To Distinguish the lubricants in the industries.
4	To Categorize various types of paints using in the industries.
5	To Distinguish the various petroleum products.

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

CO1.	Discuss the various metallic materials using in industries.	Understand
CO2.	Interpret the various smart materials and its applications.	Apply
CO3.	Compare the different lubricants with their properties.	Analyze
CO4.	Relate the various surface coatings.	Apply
CO5.	Categorize the different petroleum products.	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

METALS AND ALLOYS

Engineering materials: Ferrous materials, Aluminium, Copper, Nickel, Magnesium, Titanium alloys for engineering applications. Phase diagrams, properties and typical alloys with reference to their applications.

SMART MATERIALS

Shape Memory Alloys, Varistors and Intelligent materials for bio-medical applications, Polymers and Plastics from industry. Development, important properties and smart applications of polymeric materials.

LUBRICANTS

Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pour point) and their determination.

PAINTS

surface Coatings: Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings- Paints, pigments, Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents.

Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

PETROLEUM AND PETROCHEMICAL INDUSTRY

Composition of crude petroleum- Refining and different types of petroleum products and their applications - Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass) - synthetic fuels (gases and liquids).

Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

Text Books

1. Industrial chemistry by B.K.Sharma. Goel publishing home.
2. Engineering Material Technology, 5th edition, by James A.Jacobs & Thomas F. Kilduff.

Reference Books

1. An Introduction to Industrial chemistry by C,A.Heaton. Springer publications.
2. Engineering materials1: An introduction to properties, applications and design by Michael F Ashby and David R H Jones, Elsevier Butterworth Heinmann Publishers, 2007

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Mr.A.Gilbert sunderraj	Associate Professor	Chemistry/VMKVEC	gilbertsunderraj@vmkvec.edu.in
2	Dr.R.Nagalakshmi	Professor	Chemistry/AVIT	nagalakshmi.chemistry@avit.ac.in

	MATHEMATICS FOR MECHANICAL SCIENCES	Category	L	T	P	Credit
		BS	2	1	0	3

Preamble

This course provides a solid undergraduate foundation in partial differential equations, probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the real world. Partial differential equations are derived from physics and instruct the methods for solving boundary value problems, that is, methods of obtaining solutions which satisfy the conditions required by the physical situations such as Heat flow equations of one dimension and two dimensions. Fourier analysis is to represent complicated functions in terms of simple periodic functions, namely cosines and sines. Statistics is permeated by probability. Statistics has been responsible for accelerating progress in all applied sciences by defining the correct methods of planning, collecting, analyzing and interpreting data for establishing cause and effect relationship.

Prerequisite : Engineering Mathematics

Course Objective

1	To formulate and solve partial differential equations.
2	To represent a periodic function as a Fourier series.
3	To be familiar with applications of partial differential equations.
4	To provide an understanding for the graduate on statistical concepts to include measures of central tendency, curve fitting, correlation and regression.
5	To be familiar with discrete and continuous random variables.

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

CO1.	Explain the methodology of forming and solving partial differential equations.	Apply
CO2.	Demonstrate periodic functions arising in the study of engineering problems as Fourier series of sine and cosines and compute the Fourier coefficients numerically.	Apply
CO3.	Solve partial differential equations arising in engineering problems like wave equations and heat flow equation by Fourier series	Apply
CO4.	Apply least square method to fit a curve for the given data and evaluate the correlation coefficient and regression lines for the data	Apply
CO5.	Apply concepts of probability, discrete and continuous random variables.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

PARTIAL DIFFERENTIAL EQUATIONS

Formation - Solutions of standard types f(p,q)=0, clairauts 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.

FOURIER SERIES

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

BOUNDARY VALUE PROBLEMS

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

STATISTICS

Measures of central tendency, Curve fitting – Straight line and Parabola by least square method, Correlation, Rank correlation and Regression**.**

VECTOR CALCULUS

Probability Concepts – Random Variables - Discrete and Continuous Random Variables- Probability mass function – Probability density functions - Moment Generating Functions and their properties.

Text Books

1. S.C. Gupta, V.K. Kapoor, "Fundamentals of mathematical statistics", Sultan Chand & Sons (2017).
2. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
3. T. Veerarajan, "Probability, Statistics and Random processes" 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi (2006).

Reference Books

1. Dr.A. Singaravelu, "Transforms and Partial differential Equations", 18th Edition, Meenakshi Agency, Chennai (2013).
2. Dr.A. Singaravelu, "Probability and Statistics", Meenakshi Agencies, Chennai (2016).

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	Nil			

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr. S. Punitha	Associate Professor	Mathematics/VMKVEC	punitha@vmkvec.edu.in
2	Ms. S. Sarala	Associate Professor	Mathematics/AVIT	sarala@avit.ac.in

	NUMERICAL METHODS FOR MECHANICAL SCIENCES	Category	L	T	P	Credit
		BS	2	1	0	3

Preamble

This course provides an introduction to the basic concepts and techniques of numerical solution of algebraic equation, system of algebraic equation, numerical solution of differentiation, integration, interpolations and applications to computer science and engineering, and science areas and develops problem solving skills with both theoretical and computational oriented problems.

Prerequisite : 1.Engineering Mathematics
2.Mathematics for Mechanical Sciences

Course Objective

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

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

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

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

SOLUTION OF LINEAR EQUATIONS

Solution of linear system – Gaussian elimination and Gauss-Jordan methods – LU-decomposition methods – Jacobi and Gauss-Seidel iterative methods – sufficient conditions for convergence – Power method to find the dominant eigenvalue and eigenvector.

SOLUTION OF NONLINEAR EQUATIONS

Solution of nonlinear System – Bisection method – Secant method – Regula falsi method – Newton-Raphson method for $f(x) = 0$ – Order of convergence – Horner's method.

METHODS OF INTERPOLATION, NUMERICAL DIFFERENTIATION AND

INTEGRATION

Newton's forward, backward and divided difference interpolation –Lagrange's interpolation – Numerical Differentiation and Integration –Trapezoidal rule –Simpson's 1/3 and 3/8 rules -Curve fitting -Method of least squares and group averages.

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

Euler's method – Euler's modified method – Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations -Multistep methods – Milne's and Adams' methods.

BOUNDARY VALUE PROBLEMS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

Numerical solution of Laplace equation and Poisson equation by Liebmann's method – s lution of one dimensional heat flow equation – Bender-Schmidt recurrence relation – Crank -Nicolson method – Solution of one dimensional wave equation.

Text Books

1. S.K Gupta, "Numerical Methods for Engineers", New Age International Pvt. Ltd. Publishers (2015).
2. S.R.K. Iyengar, R.K. Jain, Mahinder Kumar Jain, "Numerical methods for Scientific and Engineering Computations", New Age International publishers, 6th Edition (2012).
3. T. Veerarajan, T.Ramachandran, "Numerical Methods with Programs in C and C++", Tata McGraw-Hill (2008).

Reference Books

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

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	Nil			

Course Designers

S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	Dr. M.Vijayarakavan	Associate Professor	Mathematics/VMKVEC	vijayarakavan@vmkvec.edu.in
2	Dr. S. Gayathri	Assistant Professor	Mathematics/AVIT	gayathri@avit.ac.in

	RESOURCE MANAGEMENT TECHNIQUES	Category	L	T	P	Credit
		BS	2	1	0	3

PREAMBLE

Operations Research is the study of optimization techniques and its helps in solving problems in different environments that need decisions like, Inventory control problems, Maintenance and Replacement problems, Sequencing and Scheduling problems, Assignment of Jobs to applicants, Transportation problems, Network problems and Decision models. Entire subject is useful for all resource managers of various fields.

Prerequisite : NIL

Course Objective

1	To be thorough with linear programming problem and formulate a real world problem as a mathematical programming model\
2	To Study and acquire knowledge on engineering and Managerial solutions in Assignment and scheduling problems.
3	To acquire skills in handling techniques of PERT, CPM and sequencing model to perform operation among various alternatives.
4	To be get exposed to the concepts of Inventory control.
5	To study decision theory and game theory techniques to analyze the real world systems

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

CO1.	Formulate the Linear programming problem. Conceptualize the feasible region. Solve the LPP with two variables using graphical method and by simplex method.	Apply
CO2.	Solve specialized linear programming problems like the Transportation and Assignment problems.	Apply
CO3.	Solve network problems using CPM, PERT techniques and sequencing model.	Apply
CO4.	Design a continuous or periodic review inventory control system	Apply
CO5.	Work in a team, specifically to solve larger problem, communicate technical knowledge. Partition a problem into smaller tasks and complete tasks on time.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

LINEAR MODELS: Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, Graphical method, Simplex Method – The Big –M

method –Duality principle

TRANSPORTATION AND ASSIGNMENT MODELS: Transportations problem: North West Corner Method, Least Cost Method, Vogel's Approximation Method, Modified Distribution Method, Unbalance and Degeneracy in Transportation Model, Assignment problem: Hungarian algorithm, Unbalanced Assignment problems - Maximization case in Assignment problems, traveling salesman problem.

NETWORK MODELS: Basic terminologies, constructing a project network, network computations in CPM and PERT, Sequencing Models: Scheduling – processing n jobs through two machines, processing n jobs through three machines, processing n jobs through m machines.

INVENTORY MODELS: Variables in inventory problems – Economic Order Quantity Model – Purchasing Model (with and without shortages) – Manufacturing Model (with and without shortages) - Stochastic Inventory Model (Stock in discrete and continuous units). Inventory models with quantity discount, safety stock, multi-item deterministic model.

DECISION MODELS: Decision Model – Game theory – Two Person Zero sum game – Algebraic solutions Graphical solutions, Matrix Oddment method for nxn games (Arithmetic Method) – Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy.

TEXTBOOKS:

1. H.A.Taha, "Operations Research: An Introduction", 10th Edition, Prentice Hall of India (2019).
2. F.S Hillier and G.J. Lieberman, "Introduction to Operations Research: Concept and Cases", McGraw-Hill International (2012).

REFERENCES:

1. Kanti Swarup, P.K.Gupta, Man Mohan, "Operations Research", S.Chand & Sons, New Delhi (2014).
2. Sundarasen.V, Ganapathy Subramaniyam, K.S, Ganesan.K. "Resource Management Techniques", A.R. Publications, Chennai (2013).
3. Premkumar Gupta, D.S. Hira, "Operations Research", S.Chand & company New Delhi (2014).

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	Nil			

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr.S.Punitha	Associate Professor	Mathematics	punitha@vmkvec.edu.in
2	Dr. M.Thamizhsudar	Associate Professor	Mathematics	thamizhsudar@avit.ac.in

	PROBABILITY AND STATISTICS	Category	L	T	P	Credit
		BS	2	1	0	3

Preamble

Probabilistic and statistical analysis is mostly used in varied applications in Engineering and Science. Statistical method introduces students to cognitive learning in statistics and develops skills on analyzing the data by using different tests and designing the experiments with several factors. Statistical Quality control is a method of quality control which employs statistical methods to monitor and control a process and ensure the process operates efficiently, producing more specification-conforming product. Based on this, the course aims at giving adequate exposure in random variables, probability distributions, regression and correlation, test of hypothesis and statistical quality control.

Prerequisite : Nil

Course Objective

1	To get the knowledge on concepts of random variables and distributions with respect to how they are applied to statistical data.
2	To acquire skills in handling situations involving more than one random variable and functions of random variables
3	To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.
4	To be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation
5	To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling.

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

CO1.	Select an appropriate probability distribution to determine probability function for solving engineering problem.	Apply
CO2.	Derive the marginal and conditional distributions of bivariate random variables.	Apply
CO3.	Apply the concepts of large/small sample tests into real life problems.	Apply
CO4.	Interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations.	Apply
CO5.	Prepare Control charts and decide on the in-control status of the process. Estimate whether a lot is acceptable or unacceptable based on acceptance sampling plans.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	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	M	--	--	--	L	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

STANDARD DISTRIBUTION

Standard Distributions - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions.

TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression Analysis

TESTING OF HYPOTHESIS

Sampling distributions – Statistical hypothesis – Testing of hypothesis for mean, variance, and proportions for large and Small Samples (Z, t and F test) - Chi-square Tests for Goodness of fit - independence of attributes.

DESIGN OF EXPERIMENTS

Analysis of Variance – One Way Classification – Two Way Classification – Completely Randomized Design – Randomized Block Design – Latin Square Design.

STATISTICAL QUALITY CONTROL

Introduction – Process control – Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling – single sampling, double sampling, multiple sampling and sequential sampling.

Text Books

1. S.P. Gupta, "Statistical Methods", 45th Edition, Sultan Chand & Sons Publishers (2017).
2. Douglas C. Montgomery and George C.Runger, "Applied Statistics and Probability for Engineers", 6th Edition, Wiley (2013).

Reference Books

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, New Delhi (2020).
2. Miller, "Probability and Statistics for Engineers", 9th Edition, Freund-Hall, Prentice India Ltd. (2017).

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	Nil			

Course Designers

S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	Dr.M.Vijayarakavan	Associate Professor	Mathematics/VMKVEC	vijayarakavan@vmkvec.edu.in
2	Dr. A.K.Bhuvaneswari	Associate Professor	Mathematics/AVIT	bhuvaneswari@avit.ac.in

PROGRAM CORE COURSES

PROGRAM CORE COURSES

	MANUFACTURING PROCESSES	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

This course provides an introduction to Basic Manufacturing Process with a focus casting, welding, forming process, Sheet metal working and plastic Engineering and also provides knowledge on the working, advantages, limitations and applications of various machining processes. Machine tools are power driven machine for making products of a given shape, size and accuracy by removing metal from the metal block

Prerequisite : NIL

Course Objective

1	To identify and explain manufacturing concepts
2	To understand the manufacturing process of conventional and special casting process of foundry technology
3	To impart the knowledge of various types welding process in metal joining processes.
4	To apply fundamentals of metal cutting processes and cutting tools.
5	To apply the knowledge of different operations on special machines and various types of work holding devices
6	To impart the knowledge of various metal forming processes.
7	To know the working principles of the various unconventional, conventional machining operations and also metal forming processes

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

CO1.	Discuss the concept of manufacturing concepts and new technologies used in industry.	Understand
CO2.	Explain the working principles of various metal casting processes and to identify the defects and interpret causes in the product of metal casting processes.	Understand
CO3.	Discuss the working principles of various metal joining processes and machines/equipments used and Select the suitable joining methods for fabrication/ assembly of products.	Understand
CO4.	Understand the chip formation for different cutting forces and cutting tool life.	Understand
CO5.	Understand the working principle and operations of Shaper, Milling, Drilling and boring Machines	Understand
CO6.	Apply the concepts of various metal forming processes	Apply
CO7.	Examine the working principle of various conventional machine tools, work and unconventional manufacturing processes.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MANUFACTURING

Manufacturing – Role of Manufacturing in the development of a country - classification of manufacturing processes.

CASTING

Fundamentals of metal casting – Types of patterns – sand mold making –different casting techniques – types of furnaces – Defects in castings – Testing and inspection of castings.

JOINING PROCESSES

Classification of welding processes - Principles of Oxy-acetylene gas welding-A.C metal arc welding- Resistance welding- Submerged arc welding- tungsten inert gas welding- metal inert gas welding- plasma arc welding- thermit welding- electron beam welding- laser beam welding, and identify defects in welding process - Soldering and brazing.

FUNDAMENTALS OF METAL CUTTING & CUTTING TOOLS

Basics of metal cutting: Mechanism of chip formation (orthogonal and oblique cutting)-Chip thickness ratio-Velocity ratio-Merchant circle diagram- Types of chips- Basics of cutting tools: Characteristics, Cutting tool materials, properties and applications -Tool life: Taylor's equation-Variables affecting tool life and Tool wear. Tool wear and Causes.

MACHINING PROCESSES

Introduction, Classification, working principle, operations performed: Lathe, Shaper, Planner, Horizontal milling machine, Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe. Basics of CNC machines. Super finishing processes: Lapping, Honing, Super finishing, Polishing & Buffing.

METAL FORMING PROCESSES

Cold and hot working of metals – Bulk metal forming- Sheet metal forming- High Energy Rate Forming processes: Explosive forming- Electro hydraulic forming – Electromagnetic forming.

ADVANCED MANUFACTURING TECHNOLOGY

Need and Classification of Additive Manufacturing Technology - Product development and Materials for Additive Manufacturing Technology – Tooling - Applications.

LIST OF EXPERIMENTS

1. Greens and moulding process using split pattern.
2. Joining of two metal pieces by electric arc welding.
3. Make an external thread cutting operation by using centre lathe.
4. Make a square end from a given round bar by using shaping machine.
5. Make a hexagonal block from a given round stock by using plain milling machine.
6. Make a spur gear from the given blank by using universal milling machine.
7. Make an external keyway on a given round rod by using vertical milling machine.
8. Make an internal keyway on a given hallow specimen by using slotting machine.
9. Make a grinding process on a machined surface as given surface finish by using cylindrical grinding machine.
10. Make an internal thread cutting on a given specimen as per given dimensions by the sequence drilling, boring, reaming and tapping by using respective tools and machines.

Text Books

1. Fundamental of Modern Manufacturing : Mikell P.Groover
2. A Text Book of Production Technology (Manufacturing Processes) : S. Chand.

Reference Books

1. SeropeKalpajian, Steven R.Schmid, "Manufacturing Processes for Engineering Materials", 4/e, Pearson Education, Inc. 2007.
2. Jain. R.K.,and S.C. Gupta, "Production Technology", 16th Edition, Khanna Publishers, 2001
3. E.PaulDegarmo, J.T.Black, and Ronald A. Konser, 'Materials and Processes in Manufacturing', 5th Edition, Prentice Hall India Ltd., 1997.
4. P. N. Rao, Manufacturing Technology (Volume 1) – Foundry, Forging and Welding, 4th Edition, Tata McGraw Hill Education, New Delhi, 2013.
5. Mikell P. Groover, Fundamentals of Modern Manufacturing Materials, Processes and Systems, Publishers: Wiley India, 2012.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Manufacturing Process Technology I & II	Prof. Shantanu Bhattacharya	IIT Kanpur	12 weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Jayaraman	Associate Professor	MECH/VMKVEC	jayaramanr@vmkvec.edu.in

2	C.Thangavel	Associate Professor	MECH/VMKVEC	thangavel@vmkvec.edu.in
3	M.Saravanan		MECH/AVIT	saravanan@avit.ac.in

	FLUID MECHANICS AND MACHINERY	Category	L	T	P	Credit
		CC	2	1	2	4

Preamble

The students completing this course are expected to understand the role of mechanisms and its applications.

Prerequisite : NIL

Course Objective

1	To learn about the application of mass and momentum conservation laws for fluid flows
2	To understand the kinematics of the fluid flow.
3	To understand the importance of dimensional analysis
4	To obtain the velocity and pressure variations in various types of simple flows.
5	To analyze the flow in water pumps and turbines

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

CO1.	Explain the application of mass and momentum conservation laws for fluid flows	Understand
CO2.	Explain the application of kinematics of the fluid flow.	Apply
CO3.	Explain the importance of dimensional analysis	Apply
CO4.	Analyze about the velocity and pressure variations in various types of simple flows.	Analyze
CO5.	Analyze of flow in water pumps and turbines	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC CONCEPTS AND PROPERTIES

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.

KINEMATICS OF THE FLUID FLOW

Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.

DIMENSIONAL ANALYSIS

Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis.

HYDRAULIC PUMPS

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle

HYDRAULIC TURBINES

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge given Orifice Meter
2. Determination of the Coefficient of discharge given Venturi Meter
3. Determination of friction factor for a given set of pipes.
4. Conducting experiments and drawing the characteristic curves of Centrifugal Pump/Submersible Pump
5. Conducting experiments and drawing the characteristic curves of Reciprocating Pump
6. Conducting experiments and drawing the characteristic curves of Gear Pump
7. Conducting experiments and drawing the characteristic curves of Jet Pump
8. Conducting experiments and drawing the characteristic curves of Kaplan Turbine
9. Study about the performance characteristics curves of Pelton wheel & Francis Turbine

Text Books

1. Bansal- R.K. - "Fluid Mechanics and Hydraulics Machines"- (5th edition)–Laxmi Publications (P) Ltd- New Delhi 2005.
2. Modi.P.N. & Seth.S.M., a Textbook on Fluid Mechanics, Standard Publishers Ltd.

Reference Books

1. White- F.M. - "Fluid Mechanics"- Tata McGraw-Hill- 5th Edition- New Delhi- 2003.
2. Ramamurtham. S- "Fluid Mechanics and Hydraulics & Fluid Machines"-Dhanpat Rai & Sons, Delhi- 2003.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1				
2	B.SelvaBabu	Assistant Professor	Mech / AVIT	selvababu@avit.ac.in

	MECHANICS OF MACHINES	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

The students completing this course are expected to understand the role of mechanisms and its applications.

Prerequisite : NIL

Course Objective

1	To Demonstrate the various types of kinematics of mechanisms.
2	To study the gear nomenclature and illustrate the various types of gears and gear trains
3	To study and construct the cam profile
4	To categorize the knowledge of static force analysis.
5	To analyze the balancingof masses and vibrations.

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

CO1.	Explain the principles involved in mechanics of machines.	Understand
CO2.	Solve problems related to gear tooth for various applications	Apply
CO3.	Construct cams and followers for specified motion profiles.	Apply
CO4.	Analyze about the various static and dynamic forces.	Analyze
CO5.	Analyze balancing problems in rotating and reciprocating parts of machinery.	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

KINEMATIC OF MECHANICS

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods.

GEARS AND GEAR TRAINS

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains

KINEMATICS OF CAM

Classifications - Displacement diagrams-parabolic- Simple, harmonic and Cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - circular arc and tangent cams - Standard cam motion

FORCE ANALYSIS

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and four members – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machine members.

BALANCING AND VIBRATION

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines-Direct and reverse crank method

Free vibrations – Equations of motion – natural Frequency – Damped Vibration –critical speed of simple shaft – Torsional vibration – Forced vibration

LIST OF EXPERIMENTS

1. To perform an experiment on Watt and Porter Governor to prepare performance characteristic curves and to find stability and sensitivity
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation
3. To analyse the motion of a motorized gyroscope when the couple is applied along its spin axis and determine gyroscopic couple
4. Determine the Moment of Inertia by compound pendulum and tri-filar suspension.
5. To determine the frequency of undamped free vibration and damped forced vibration of an equivalent spring mass system.
6. To determine whirling speed of shaft theoretically and experimentally.

Text Books

1. Ambekar A.G., ―Mechanism and Machine Theory‖ Prentice Hall of India, New Delhi, 2007
2. Shigley J.E., Pennock G.R and Uicker J.J., ―Theory of Machines and Mechanisms‖, Oxford University Press, 2003
3. Khurmi.R.S. and Gupta, Theory of Machines, S.Chand @ Co., 2005.

Reference Books

1. Thomas Bevan, ―Theory of Machines‖, CBS Publishers and Distributors, 1984.
2. Ghosh.A, and A.K.Mallick, ―Theory and Machine‖, Affiliated East-West Pvt. Ltd., New Delhi,
3. Rao.J.S. and Dukkipatti R.V. ―Mechanisms and Machines‖, Wiley-Eastern Ltd., New Delhi, 1992.
4. Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 2002
5. Robert L.Norton, "Design of Machinery", McGraw-Hill, 2004.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Kinematics of Mechanisms and Machines	Prof. A. Dasgupta	IIT Kharagpur	12 Weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr.S.Venkatesan	Professor	MECH/ VMKVEC	venkatesan@vmkvec.edu.in
2				

	MECHANICAL BEHAVIOUR OF MATERIALS AND METALLURGY	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

This course to imparts through knowledge on the metallic and nonmetallic materials, mechanical testing methods and deformation mechanisms in crystalline solid materials. Also the mechanical treatment process, corrosion and advanced materials pertaining to Mechanical Engineers.

Prerequisite : NIL

Course Objective

1	To develop the broad knowledge of the classification, properties and application of various Engineering Materials.
2	To provide an understanding to students on the mechanical properties and performance of materials.
3	Identify the suitable mechanical treatment methods for selecting ferrous and non ferrous materials.
4	Develop the knowledge of the various forms of corrosion and powder metallurgy fabrication methods
5	To give insight to advanced materials such as polymers, ceramics and composite and their applications.

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

CO1.	Understand the concepts of structure properties, performance and processing related to metallurgy and materials.	Understand
CO2.	Evaulate the mechanical behaviour of materials and the effect of mechanical properties.	Apply
CO3.	Correlate the structure-property relationship in metal/alloys in as-received and heat treated conditions.	Apply
CO4.	Predict the formation of corrosion, mechanism and to prevent corrosion and powder metallurgy fabrication methods.	Apply
CO5.	Apply advanced materials such as polymers, ceramics and composites in product design.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

FERROUS & NON-FERROUS MATERIALS

Classification of cast iron and steels – properties, microstructures and uses of cast irons, plain carbon, alloy steels, HSLA, stainless, tool and die steels & maraging steels. Properties, microstructures and uses of non – ferrous alloys – copper, aluminium and nickel alloys. Phase diagrams - Iron – Iron carbide equilibrium diagram.

MECHANICAL BEHAVIOR OF MATERIALS

Introduction to plastic deformation - Slip and twinning – Types of fracture – ductile fracture, brittle fracture, - Fatigue – Fatigue test, S-N curves, Creep and stress rupture fatigue – mechanism of creep. Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers & Rockwell), Impact test Izod and charpy.

MATERIAL TREATMENT

Heat treatment - Overview- objectives – Annealing and types, Normalizing - Hardening and

Tempering, Austempering and martempering. Case hardening process- Carburizing- nitriding - cyniding and carbonitriding, flame and induction hardening. Hardenability - Jominy end quench test.Time Temperature Transformation (TTT) and Cooling Curve Transformation (CCT) curve.

POWDER METALLURGY AND CORROSION

Powder metallurgy–powder production, blending, compaction, sintering-applications, Introduction- forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods - PVD, CVD.

INTRODUCTION TO ADVANCED MATERIALS

Polymers – types of polymer, Properties and applications of various Engineering polymers (PP,PS, PVC, PMMA, PET,PC, PA, ABS, PI,PAI,PPO,PPS,PEEK, PTEF, Urea and phenol formaldhydes. Composites - Types- Metal Matrix Composites (MMC), Polymer Matrix Composites (PMC), Ceramic Matrix Composites (CMC) – properties,processing and applications. Ceramics – properties and applications of SiC, Al2O3, Si3N4, PSZ and SIALON

LIST OF EXPERIMENTS

1. Introduction to Metallographic
2. Preparation metallographic specimen
3. Identification of Ferrous specimens (Minimum 5)
4. Identification of Non-Ferrous specimen (Minimum 2)
5. Heat treatment – Annealing – comparation between annealed and unheat treated specimen.
6. Heat treatment – Normalizing – comparation between annealed and unheat treated specimen.

Text Books

1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2010–8thEdition.
2. Sydney H.Avner “Introduction to Physical Metallurgy” McGraw Hill Book Company – Prentice Hall 2014- 8th Edition.
3. V. Raghavan , “ Materials Science and Engineering”, PHI, Sixth Edition

Reference Books

1. George E. Dieter, “Mechanical Metallurgy” – TATA McGraw Hill – 2013 – 3rd Edition
2. Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India
3. Upadhyay. G.S. and AnishUpadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd., New Delhi, 2006.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Mechanical Behaviour of Materials	Prof. S. Shankar	IIT Madras	12 Weeks
2	Materials Science and Engineering	Dr. Vivek Pancholi	IIT Roorkee	12 Weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	S. Arunkumar	Assistant Professor	MECH/VMKVEC	arunkumar@vmkvec.edu.in
2	M.Thiruchirambalam	Professor	MECH/AVIT	thiru.mech@avit.ac.in

	STRENGTH OF MATERIALS	Category	L	T	P	Credit
		CC	2	1	2	4

Preamble

The students completing this course are expected to understand the role of mechanisms and its applications.

Prerequisite : NIL

Course Objective

1	To know the behavior of material at various loading conditions in compression and tension.
2	Understand and analyze shear force and bending moment in various loading conditions.
3	To know the phenomenon of bending of different sections and its analysis and recognize principle stresses.
4	To understands various columns sections and geometrical analysis.
5	Concepts of strain energy, torsion and numerical analysis.

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

CO1.	Explain the behavior of material at various loading conditions in compression and tension.	Understand
CO2.	Analyze shear force and bending moment in various loading conditions.	Apply
CO3.	Analyze the phenomenon of bending of different sections and recognize principle stresses.	Analyze
CO4.	Analyze about the various columns sections and geometrical.	Analyze
CO5.	Analyze of strain energy, torsion and numerical analysis.	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

STRESSES AND STRAINS

Stress and strain due to axial force – Strain energy due to axial force –sudden load and impact load. Poisson's ratio– volumetric strain– shear stress–shear strain. Thin cylindrical and spherical shells under internal pressure. Thermal stresses. Principal stresses and planes – Mohr's circle for plane stress and plane strain. Strain gauges and rosettes.

BENDING MOMENT AND SHEAR FORCE IN BEAMS

Shear force and bending moment diagrams for cantilever, simply supported and overhanging beams under concentrated loads, uniformly distributed loads, uniformly varying loads, concentrated moments – maximum bending moment and point of contra flexure.

FLEXURE & TORSION IN BEAMS

Theory of simple bending and assumptions – flexure equation. Theory of torsion and assumptions – torsion equation – power transmitted by a shaft.

DEFLECTION OF DETERMINATE BEAMS

Governing differential equation – Macaulay's method – moment area method – application to simple problems (cantilever beams and simply supported beams only).

COLUMNS AND STRUTS

Columns – behaviour of axially loaded short and long column members – buckling load – Euler's theory – different end conditions – Rankine's formula.

LIST OF EXPERIMENTS

1. Direct Shear Test on Mild Steel Rod and Mild Steel Plate
2. Brinell Hardness Test
3. Izod Impact Test
4. Bending Test on Mild Steel
5. Rockwell Hardness Test
6. Tensile Test on Mild Steel
7. Compression test& Torsion test on Mild Steel

Text Books

1. Bedi D.S., "Strength of Materials", Khanna Publishing House, 2017.
2. Jindal U C, "Strength of Materials", Asian Books Pvt Ltd, New Delhi, 2007.
3. Rajput.R K, "Strength of Materials", S.Chand& Co Ltd, New Delhi, 1996.

Reference Books

1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 1997
2. Subramanian R, "Strength of Materials", Oxford University Press, Oxford Higher Education Series, Oxford, 2007
3. Hibbeler R.C, "Mechanics of Materials", Pearson Education, New Jersey, 2007
4. Bansal R.K, "Strength of Materials", Lakshmi Publications(P)Ltd, New Delhi,2010
5. Ferdinand P Been, Russell Johnson,J.R. and John J Dewole, "Mechanics of Materials", Tata Mcgraw Hill Publishing Co Ltd, New Delhi, 2006

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	STRENGTH OF MATERIALS	PROF. SRIMAN KUMAR BHATTACHARYYA	IIT KGP	12 Weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr.S.Sangeetha	Associate Professor	Mech/AVIT	sangeethas@avit.ac.in
2				

	ENGINEERING THERMODYNAMICS	Category	L	T	P	Credit
		CC	2	1	2	4

Preamble

This course provides an introduction to the basic concepts in thermodynamics, first law of thermodynamics and energy, second law, entropy, enthalpy and internal energy, ideal and real gases and non-reactive ideal gas mixtures and general thermodynamic property relations. It develops the problem solving skills in engineering problems in basic thermodynamics.

Prerequisite :

Course Objective

1	To learn about work and heat interactions, and balance of energy between system and its surroundings
2	To learn about application of I law to various energy conversion devices
3	To evaluate the changes in properties of substances in various processes
4	To understand the difference between high grade and low grade energies
5	To understand the II law limitations on energy conversion.

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

CO1.	To assess the basic elements & various modes of heat transfer Used in Engineering applications.	Understand
CO2.	To solve the engineering problems using various methods of Transient heat conduction technologies	Apply
CO3.	To apply the concepts of convection systems in an engineering problem using standard values	Apply
CO4.	To choose the various concepts of radiation based on the requirements for the given problems	Apply
CO5.	To solve the engineering problems using Boiling , Condensation and heat transfer rate of heat exchangers using LMTD and NTU method	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF THERMODYNAMIC

Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work - Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work. Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.

FIRST AND SECOND LAW OF THERMODYNAMICS

First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume. Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale

CLAUSIUS INEQUALITY, IRREVERSIBILITY AND AVAILABILITY

Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Energy balance equation and Exergy analysis.

PURE SUBSTANCE AND GAS MIXTURES

Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart

THERMODYNAMIC CYCLES AND RELATIONS

Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle. Thermodynamic relations : Thermodynamic potentials, thermodynamic gradients, general thermodynamics relations, entropy (Tds) equations, equations for internal energy and enthalpy, equation of state, coefficient of expansion and compressibility, specific heats, Joule Thomson coefficient, Clausius –Claperyon equation, Maxwell's relations.

LIST OF EXPERIMENTS

IC Engine Valve Timing diagrams.
IC Engine Port Timing diagrams.
Determination of Flash Point and Fire Point of Various fuels / Lubricant
Determination of Viscosity of Various fuels / Lubricant
Actual P-V diagrams of IC engines.
Determination of Calorific value of liquid fuel

Text Books

1. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Basic Thermodynamics	Prof. Suman Chakraborty	IIT Kharagpur	12 weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Anandan	Associate Professor	MECH/VMKVEC	anandan@vmkvec.edu.in
2	Dr.P. Sellamuthu	Associate Professor	MECH/VMKVEC	sellamuthu@vmkvec.edu.in
2	C.Thiagarajan	Associate Professor	MECH/AVIT	cthiagarajan@avit.ac.in

	THERMAL ENGINEERING	Category	L	T	P	Credit
		CC	2	1	2	4

Preamble

This course imparts understanding about the power generation using heat energy conversion and makes an attempt to be conversant with the equipment's used in the process. It helps in understanding the thermodynamic concepts, the construction and the working principles of various engineering devices

Prerequisite : Engineering Thermodynamics

Course Objective

1	To learn about of reacting systems and heating value of fuels
2	To learn about gas and vapor cycles and their first law and second law efficiencies
3	To understand about the properties of dry and wet air and the principles of psychrometry
4	To learn about gas dynamics of air flow and steam through nozzles
5	To learn the about reciprocating compressors with and without intercooling and performance of steam turbines

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

CO1.	To assess the basic of reacting systems and heating value of fuels	Understand
CO2.	Apply the gas and vapor cycles and their first law and second law efficiencies	Apply
CO3.	Apply the properties of dry and wet air and the principles of psychrometry	Apply
CO4.	Apply the concept of gas dynamics of air flow and steam through nozzles	Apply
CO5.	Analyze the reciprocating compressors with and without intercooling and performance of steam turbines	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO SOLID, LIQUID AND GASEOUS FUELS

Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.

GAS AND VAPOR CYCLES

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.

PROPERTIES OF DRY AND WET AIR

Properties of dry and wet air,use of pschyrometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.

COMPRESSIBLE FLOW

Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, supersaturation- compressible flow in diffusers, efficiency of nozzle and diffuser.

RECIPROCATING COMPRESSORS AND STEAM TURBINE

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.
Analysis of steam turbines, velocity and pressure compounding of steam turbines

LIST OF EXPERIMENTS

1. Load Test on a four stroke Single cylinder diesel engine.
2. Load Test on a four stroke twin cylinder diesel engine.
3. Performance and Emission test of a four stroke multi-cylinder Petrol engine.
4. Performance and Emission test of a four stroke multi-cylinder Diesel engine.
5. Morse Test on a multi-cylinder petrol engine.
6. Performance test of a bio-fuel on a variable compression ratio engine.

Text Books

1. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India
2. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.
2. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

Alternative NPTEL/SWAYAM Course - Nil

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Nil			

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Anandan	Associate Professor	MECH/VMKVEC	anandan@vmkvec.edu.in
2	Dr.P. Sellamuthu	Associate Professor	MECH/VMKVEC	sellamuthu@vmkvec.edu.in
3	C.Thiagarajan	Associate Professor	MECH/AVIT	cthiagarajan@avit.ac.in

	DESIGNOF MACHINE ELEMENTS	Category	L	T	P	Credit
		CC	2	1	0	3

Preamble

Students will be able to demonstrate the fundamentals of stress analysis, theories of failure and material science in the design of machine components. Students will be able to make proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components. Enable the students to have high ethical standards in terms of team work to be a good design engineer

Prerequisite : NIL

Course Objective

1	Develop an ability to apply knowledge of mechanics and materials.
2	Develop an ability to design various machine elements with practical constraints by applying standard design procedures.
3	Utilize the codes and standard design principles.
4	Apply Design principles and validation for critical safety analysis.
5	Understand the background in material failure through the study of theories of failure.

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

CO1.	Explain the influence of steady and variable stresses in machine component design.	Understand
CO2.	Analyze machine components using theories of failure for defined load conditions	Analyze
CO3.	Apply the design principles in shafts and couplings for defined constraints.	Apply
CO4.	Apply the design principles in bolted and welded joints for defined constraints.	Apply
CO5.	Apply the design principles in mechanical springs for steady and varying load conditions	Apply
CO6.	Apply the design principles in bearing for defined constraints	Apply
CO7.	Apply the design principles in flywheel for defined constraints	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO DESIGN PROCESS WITH VARIOUS STRESS COMBINATIONS

Introduction to the design process - factor influencing machine design – Direct – Bending and torsional stress equations –Impact and shock loading-Calculation of principal stresses for various load combinations – Factor of safety-theories of failure–stress concentration –design for variable loading – Soderberg – Goodman and Gerber relations

DESIGN OF SHAFTS AND COUPLINGS

Design of solid and hollow shafts based on strength – rigidity and critical speed – Design of rigid and flexible couplings.

DESIGN OF BOLTED AND WELDED JOINTS

Threaded fasteners – Design of bolted joints – Design of welded Joints for pressure vessels and structures.

DESIGN OF SPRINGS

Design of helical, leaf and torsional springs under constant loads and varying loads.

DESIGN OF BEARINGS

Design of bearings – sliding contact and rolling contact types – Design of journal bearings.

DESIGN OF FLYWHEELS

Design of flywheels involving stresses in rim and arm.

Text Books

1. Design of Machine Elements-V.B.Bhandari
2. Mechanical Engineering Design:JosephE Shigley and CharlesR.Mischke

Reference Books

1. Machine Design:Robert L.Norton,Pearson Education,2001
2. Design of Machine Elements-M.F.SPotts,T.E.Shoup,pearsonEdn,2006.
3. Fundamentals of Machine component Design–RobertC.Juvinall,Wiley India Pvt.Ltd,3rdEdn,2007.
4. Design Data – PSG College of Technology, DPV Printers, Coimbatore, 2012.
5. P.C.Sharma&D.K.Aggarwal, A Text Book of Machine Design, S.K.Kataria& Sons, New Delhi,12th edition, 2012 .

Alternative NPTEL/SWAYAM Course – Nil

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
	-	-	-	-

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Venkatesh	Assistant Professor	MECH/VMKVEC	venkatesh@vmkvec.edu.in
2	J. SENTHIL	Associate Professor	MECH/AVIT	jsenthil@avit.ac.in

	ENGINEERING METROLOGY AND MEASUREMENTS	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

The aim of the subject is to provide basic knowledge in instrumentation and measurements. Familiarization with basic concepts and different instrumentation and measurement strategies being used in practice.

Prerequisite : NIL

Course Objective

1	To apply the fundamentals of basic engineering measurement system.
2	To understand the various instruments used for linear, angular measurement, form measurement and surface finish
3	To apply the knowledge of different measuring instruments like linear, angular measurement, form measurement and surface finish
4	To understand the principle, concepts, applications and advancements of temperature, pressure and flow measurements
5	To use information to classifications, working and processes of optical measuring instruments, also to acquire the data and store in computer

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

CO1.	Explain the sensitivity of the instruments by evaluating the error in measurements	Understand
CO2.	Discuss the working principle and usage of various instruments used for linear, angular measurement, form measurement and surface finish	Understand
CO3.	Demonstrate the various setups used for measuring linear, angular measurement, form measurement and surface finish	Apply
CO4.	Determine the appropriate instruments for temperature, pressure and flow measurements	Apply
CO5.	Explain the application oriented knowledge in the use of optical measuring instruments	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	S	M	M	L	-	-	-	-	-	-	-	-	L	-	-
CO2	S	S	M	L	-	-	-	-	-	-	-	-	L	-	-
CO3	S	L	M	L	-	-	-	-	-	-	-	-	L	-	-
CO4	S	S	M	L	-	-	-	-	-	-	-	-	L	-	-
CO5	S	M	S	L	-	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC PRINCIPLES & LINEAR / ANGULAR MEASUREMENT

Basic principles of measurement - Generalized measuring system - Characteristics of measuring instruments, Static and Dynamic characteristics - Precision, Accuracy, Sensitivity, Repeatability, Reproducibility, Linearity, Errors –sources of error, classification and elimination of error- Calibration. Linear and angular Measurements: Vernier – Micrometer - Slip gauges and classification - Optical flats - Limit gauges - Comparators: Mechanical - Pneumatic and Electrical types – applications. -Sine bar - optical bevel protractor - Autocollimator- Angle Decker – Taper measurements.

DISPLACEMENT, SPEED & ACCELERATION / VIBRATIONMEASUREMENT

Measurement of displacement: Theory and construction of various transducers to measure displacement - LVDT ,piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.
Measurement of speed: Mechanical tachometers, electrical tachometers, strobe Objective, noncontact type of tachometer.
Measurement of acceleration and vibration: Piezoelectric Accelerometer, Seismic Accelerometer, Vibrometer.

TEMPERATURE, PRESSURE AND FLOW MEASUREMENT

Measurement of Temperature: Classification, ranges, various principles of measurement, expansion, electrical resitance, , Thermistor, Thermo couples, Pyrometers, temperature Indicators.
Measurement of pressure: Units, classification, different principles used, piston Digital pressure gauges, Manometers, bourdon, pressure gauges, bellows diaphragm gauges. Low pressure measurement, thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge, Knudsen gauge. Calibration of pressure gauges. Measurement of level: Direct method – indirect methods– capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – bubler level indicators
Measurement of flow: Orifice meter, Venturi meter, Rotameter, magnetic, ultrasonic, turbine flow meter, Anemometers - hotwire anemometer, Laser Doppler anemometer (LDA).

FORCE, TORQUE, & STRAIN MEASUREMENTS

Measurement of force& torque: Load cells, Dynamometers: Eddy current dynamometer, Cantilever beams, proving rings, differential transformers.
Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements.
Strain Measurements: types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge calibration.

FORM MEASUREMENTS AND OPTICAL MEASUREMENTS

Form measurements: Measurement of screw threads - thread gauges - Floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method- Gleason gear testing machine – radius measurements-surface finish - Straightness - Flatness and roundness measurements.
Optical measurements: Optical Micro Objective, interference micro Objective, tool makers micro Objective, profile projector, vision Systems, laser interferometer – linear and angular measurements.

LIST OF EXPERIMENTS

1. Angular Measurements using Bevel Protector and Sine Bar
2. Measurement of linear parameters using precision measuring instruments like micrometer, Vernier caliper and Vernier height gauge.
3. Flow Measurement using a Rotameter.
4. Fundamental dimension measurement of a gear using a contour projector.
5. Measurement of Displacement using Linear Variable Differential Transducer
6. Measurement of speed of Motor using Stroboscope
7. Measurement of cutting forces using Lathe Tool Dynamometer

Text Books

1. Kumar D.S., Mechanical Measurements and Control, Tata McGraw Hill.
2. Jain R.K., Engineering Metrology, Khanna Publishers, 1994.
3. GuptaS.C.- “Engineering Metrology”- Dhanpatrai Publications- 2018.
4. Metrology and Measurements lab Manual

Reference Books

1. Alan S. Morris- “The Essence of Measurement”- Prentice Hall of India- 1997
2. Jayal A.K- “Instrumentation and Mechanical Measurements”- Galgotia Publications 2000
3. Beckwith T.G- and N. Lewis Buck- “Mechanical Measurements”- Addison Wesley- 1999.
4. Donald D Eckman- “Industrial Instrumentation”- Wiley Eastern-1985.

Alternative NPTEL/SWAYAM Course				
S.No	**NPTEL /SWAYAM Course Name**	**Instructor**	**Host Institution**	**Duration**
1	Engineering Metrology	Prof. J. Ramkumar, Prof. Amandeep Singh	IIT Kanpur	12 Weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	S.Duraithilagar	Associate Professor	MECH/VMKVEC	duraithilagar@vmkvec.edu.in
2	R.Mahesh	Assistant Professor	MECH/AVIT	mahesh@avit.ac.in

	AUTOMOTIVE ENGINEERING	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

Automotive Engineering is a blend of both practical and theories, course the students will be able to learn the layout and arrangement of principal parts of an automobile, Engine Management and Emission Control System, working of Transmission, Suspension, Steering and brake systems along with the Advance in automotive Engineering.

Prerequisite : NIL

Course Objective

1	To impart knowledge on the constructional details and principle of operation of various Automobile components.
2	To analyzing the various types Engine Auxiliary and Engine management systems.
3	To analyzing the various types of transmission systems for a vehicle
4	To analyzing the working parameters of various braking and suspension system in a Vehicle
5	To Analyzing the Various advance in automotive Engineering

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

CO1.	Recognize the various parts of the automobile and their functions and materials.	Apply
CO2.	Analyzing the various types Engine Auxiliary and Engine management systems.	Apply
CO3.	Analyzing the various types of transmission systems for a vehicle	Apply
CO4.	Analyzing the working parameters of various braking and suspension system in a vehicle	Apply
CO5.	Analyzing the Various advance in automotive Engineering.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

VEHICLE STRUCTURE AND ENGINES

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics, IC engines –components-functions and materials, variable valve timing (VVT).

ENGINE MANAGEMENT & EMISSION CONTROL SYSTEMS

Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), Engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

TRANSMISSION SYSTEMS

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, overdrive, transfer box, fluid flywheel – propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive

STEERING, BRAKING AND SUSPENSION SYSTEMS

Steering Geometry,Types of steering Gearbox – Power Steering, Front Axle, Stub Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, ABS and Traction Control.

ADVANCES IN AUTOMOBILE ENGINEERING

Passenger comfort - Safety and security - HVAC - Seat belts - Air bags - Automotive Electronics - Electronic Control Unit (ECU). Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program (ESP) Traction Control System (TCS) - Global Positioning System (GPS) - Electric - Hybrid vehicle.

LIST OF EXPERIMENTS

1. Construction Mechanism of Petrol and Diesel engine (Four stroke and Two Stoke)
2. Construction Mechanism of Clutch Assembly
3. Construction Mechanism of Sliding mesh, Constant mesh and Synchromesh gear boxes
4. Construction Mechanism of Differential and Rear axles assembly
5. Construction Mechanism of Hydraulic brake, Disc brake and Air brake systems
6. Construction Mechanism of Suspension and Steering systems
7. Construction Mechanism of Hybrid and Electric vehicles

Text Books

1. Kirpal Singh, " Automobile Engineering Vol 1 & 2 ", Standard Publishers, Seventh Edition, New DelhiR.B. Gupta- "Automobile Engineering "- SatyaPrakashan.
2. Jain K.K. and Asthana R.B., Automobile Engineering, Tata McGraw Hill, New Delhi.
3. Gill P.S., "A Textbook of Automobile Engineering – Vol. I , II and III", S.K.Kataria and Sons, 2ndEdition.

Reference Books

1. William Crouse- "Automobile Engineering Series "- McGraw-Hill
2. Newton and Steeds- "Motor Vehicles "- ELBS
3. Duffy Smith- "Auto Fuel Systems "- The Good Heat Willcox Company Inc.
4. "Hybrid and Electric Vehicles"-CRC Press – Taylor and Francis Group.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Fundamentals of Automotive Systems	Prof C.S. Shankar Ram	IIT Madras	12 Weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	T. Raja	Associate Professor	MECH/VMKVEC	rajat@vmkvec.edu.in
2	N. Shivakumar	Assistant Professor	MECH/AVIT	shivakumar@avit.ac.in

	COMPUTER INTEGRATED MANUFACTURING	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

The students completing this course are expected to understand the nature and role of computers in manufacturing. The course includes computer aided design, fundamentals of CNC machines, programming of CNC machines, group technology, computer aided process planning techniques, shop floor control and flexible manufacturing systems. It exposes the students to various current trends followed in the industries

Prerequisite : NIL

Course Objective

1	Demonstrate basics of CAD/CAM/CIM concepts
2	To apply geometric modelling techniques and various graphics standards in CAD
3	Explain computer graphics and solid modelling techniques.
4	Demonstrate part programs and group technology techniques
5	Discuss latest advances in the manufacturing perspectives.

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

CO1.	Apply design concepts.	Apply
CO2.	Utilise CAD standards for geometrical modelling.	Apply
CO3.	Develop part programs for solid models.	Apply
CO4.	Demonstrate Solid modelling techniques.	Apply
CO5.	Apply group technology concept in manufacturing product.	Apply
CO6.	Make use of FEA concept for analysis.	Apply
CO7.	Explain FMS and CIM wheel for manufacturing industry	Apply
CO8.	Develop the model for Analyzing and manufacturing structural member.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO2	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO3	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO4	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO5	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO6	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO7	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO8	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Definition and scope of CAD/CAM- Computers in industrial manufacturing, design process- Computer Aided Design (CAD)-Computer Aided Manufacturing (CAM)-Computer Integrated Manufacturing (CIM) - Introduction to Computer graphics -Raster scan graphics-Co-ordinate systems.

GRAPHICS AND COMPUTING STANDARDS

Data base for graphic modeling-transformation geometry-3D transformations –Clipping-hidden line removal-Colour-shading-Standardization in graphics- Open GL Data Exchange standards – IGES, STEP - Graphic Kernal system (GKS).

GEOMETRIC MODELLING

Geometric construction methods-Constraint based modeling- Wireframe, Surface and Solid – Parametric representation of curves, solids & surfaces.

CNC MACHINE TOOLS

Introduction to NC, CNC, DNC - Manual part Programming – Computer Assisted Part Programming – Examples using NC codes- Adaptive Control – Canned cycles and subroutines – CAD/ CAM approach to NC part programming – APT language, machining from 3D models.

ROLE OF INFORMATION SYSTEMS IN MANUFACTURING

Discrete part manufacture-information requirements of a production organization-manufacturing strategies-Integration requirement - Group technology-coding-Production flow analysis-computer part programming-CAPP implementation techniques.

INTRODUCTION TO FEA CONCEPTS

Nodes -Meshing – Pre and Post processing – Modal analysis – Stress analysis – Steady state and Transient analysis.

AUTOMATED MANUFACTURING SYSTEMS

Flexible Manufacturing systems (FMS) – the FMS concepts – transfer systems – head changing FMS – Introduction to Rapid prototyping, Knowledge Based Engineering, Virtual Reality, Augmented Reality –automated guided vehicle-Robots-automated storage and retrieval systems - computer aided quality control-CMM-Non contact inspection methods.

LIST OF EXPERIMENTS

1. 2D Geometry –Splines
2. Surface Modelling –NURBS
3. Solid Modelling-CSG, Brep.
4. Preparing solid models for analysis-Neutral files
5. Real time component analysis-STRESS, STRAIN Analysis.
6. Model analysis of different structures.
7. Tolerance analysis of any mechanical component.
8. CNC Milling program involving linear motion and circular interpolation
9. CNC Milling program involving contour motion and canned cycles
10. CNC Milling program involving Pocket milling.
11. CNC Turning program involving turning and facing
12. CNC Turning program involving Step turning, Taper turning and Grooving
13. CNC Turning program involving Fixed/Canned cycles& Thread cutting cycles
14. Diagnosis and trouble shooting in CNC machine
15. Route sheet generation using CAM software.
16. Generation of CNC programming and machining using Master Cam/Edge Cam.

Text Books

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated
2. Radhakrishnan P, Subramanyan.S. andRaju V., "CAD/CAM/CIM", New Age International (P) Ltd., New Delhi.
3. P.N.Rao, CAD/CAM: Principles and Applications-3rd Edition, Tata McGraw Hill, India, 2010.

Reference Books

1. Yoremkoren, "Computer Integrated Manufacturing System", McGraw-Hill.
2. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International
3. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc.
4. Roger Hanman "Computer Integrated Manufacturing", Addison – Wesley
5. Viswanathan.N, Narahari.Y "Performance Modeling& Automated Manufacturing systems" Prentice hall of indiapvt. Ltd.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Computer Integrated Manufacturing	Prof. J. Ramkumar, Prof. Amandeep Singh	IIT Kanpur	12 weeks

Course Designers				
S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	L.PRABHU	Associate Professor	MECH/ AVIT	prabhu@avit.ac.in
2	M.Saravanan	Associate Professor	MECH/VMKVEC	saravanan@vmkvec.edu.in

	DESIGN OF TRANSMISSION SYSTEMS	Category	L	T	P	Credit
		CC	2	1	0	3

Preamble

Design of Transmission System course is concerned with design of mechanical transmission elements for engineering applications. In industries motors and turbines use energy to produce rotational mechanical motion. In order to harness this motion to perform useful work, there must be a way to transmit it to other components and machines. Three common methods of accomplishing this include gears, chain drives, and belt drives. The Mechanical Transmission Systems subject area covers these types of transmission systems, including specific applications, how each works.

Prerequisite : DESIGN OF MACHINE ELEMENTS

Course Objective

1	To interpret the procedure for power transmission by belt, ropes and chain drives.
2	To design the spur and helical, bevel and worm gears.
3	To explore the importance of gear box and design of gear box.
4	To assess the design procedure for cam and clutches.
5	To assess the design procedure for brakes.

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

CO1.	Design a suitable flat belt, V-belt, ropes and chain drive for specified loading condition by using pre-defined set of values and procedures.	Apply
CO2.	Determine the number of teeth, bending strength and wear strength for given spur gear, helical, bevel gear and worm gear pair by using pre-defined set of values and procedures.	Apply
CO3.	Design the gearbox and gear shaft dimensions for given speed conditions by using pre-defined set of values and procedures.	Analyze
CO4.	Develop the cam profile for various types of followers, single plate clutch and multiple plate clutch for given specified loading conditions.	Apply
CO5.	Design of brakes by using pre-defined set of values and procedures.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

DESIGN OF FLEXIBLE DRIVES

Types and configuration of belt drive, slip, initial tension, centrifugal tension, selection of flat belt drive, Selection of V-belt drives, problems-based on basic equations. Types of chain, factor of safety, selection of chain drives. Design of Sprockets.

DESIGN OF GEARS

Gear nomenclature, Spur gears: Stresses induced in gears, gear tooth failure, Lewis bending equations, Calculation of appropriate safety factors and power rating, force analysis, Design of spur gears, helical, bevel and worm gears.

DESIGN OF GEAR BOXES

Geometric progression — Standard step ratio — Ray diagram, kinematics layout -Design of sliding mesh gear box — Design of multi speed gear box for machine tool applications — Constant mesh gear box — Speed reducer unit.

DESIGN OF CAMS, CLUTCHES

Cam and follower Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim

clutches- Electromagnetic clutches.

DESIGN OF BRAKES

Band and Block brakes — external shoe brakes — Internal expanding shoe brake.

Text Books

1. Joseoh Edward Shigley, Charles R Misucke, Mechanical Engineering Design, Tata Mc Graw Hill.
2. Prabhu. T.J. - "Design of Transmission Elements"- Mani Offset- Chennai.
3. V.B. Bhandari, "Design of Machine Elements", Tata McGraw Hill.

Reference Books

1. Md.Jalaludeen- Machine Design- Anuradha Publicatiions,Chennai
2. Maitra G.M. - Prasad L.V. - "Hand book of Mechanical Design"- II Edition- Tata McGraw-
3. Sundarajamoorthy T.V. and Shanmugam. N, "Machine Design", Anuradha Publications
4. Design Data, PSG College of Technology, Coimbatore.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	J Satheesbabu	Associate Professor	MECH/VMKVEC	satheesbabu@vmkvec.edu.in
2	S.Kalyanakumar	Assistant Professor	MECH/AVIT	kalyanakumar @avit.ac.in

	HEAT TRANSFER	Category	L	T	P	Credit
		CC	2	1	2	4

Preamble

The purpose of this subject is to been able students understood different principles of heat transfer and its Extensive Engineering applications**.**

Prerequisite : ENGINEERING THERMODYNAMICS

Course Objective

1	To enable students understand their conduction mechanism in steady state emphasizing on Application in engineering.
2	To enable students understand their conduction mechanism in unsteady state emphasizing on application in engineering.
3	To categorize various types of convection and its application.
4	To assess various concepts of radiation and its Applications.
5	To enable students to understand Boiling, Condensation and Various types of Heat Exchangers.
6	To Enable students to Understand Various Heat transfer Calculations by conducting Experiments.

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

CO1.	To assess the basic elements & various modes of heat transfer Used in Engineering applications.	Understand
CO2.	To solve the engineering problems using various methods of Transient heat conduction technologies	Apply
CO3.	To apply the concepts of convection systems in an engineering problem using standard values	Apply
CO4.	To choose the various concepts of radiation based on the requirements for the given problems	Apply
CO5.	To solve the engineering problems using Boiling , Condensation and heat transfer rate of heat exchangers using LMTD and NTU method	Apply
CO6.	To Conduct experiments, interpret the data and analyze the heat transfer problems	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO HEAT TRANSFER AND STEADY STATE CONDUCTION

Heat transfer fundamentals; Basic heat transfer mechanisms (conduction, convection and radiation), Conduction -Introduction -Fourier law of conduction- General equation in Cartesian coordinates - One dimensional steady state conduction across Large plane wall, Long cylinder and Sphere- Composite wall – Composite cylinder – Composite sphere, Overall heat transfer coefficients, Critical Radius of insulation, Variable thermal conductivity, conduction with Heat generation, - Fins or extended

surfaces- Pin fins, annular fins, longitudinal fins, fins efficiency and fins effectiveness- Problems.

TRANSIENT HEAT CONDUCTION

Introduction – Lumped system analysis, semi – infinite solids. Transient Heat Conduction in Large Plane Walls, Long cylinders and Spheres. Significance of Biot and Fourier numbers, Transient heat transfer analysis of an infinite slab with specified temperature and connective boundary conditions. - Refrigeration and Freezing of Foods- Problems.
Use of Grover & Heisler charts for solving problems of infinite slabs, cylinders, spheres.

CONVECTION

Introduction – Physical Mechanism on Convection, Classification of Fluid Flows, Significance of non-dimensional numbers, Velocity Boundary Layer, Thermal Boundary Layer, Laminar and Turbulent Flows. External Forced convection – Flow over a Flat plate, cylinder, sphere and Tube Banks. Internal Forced Convection - Flow through pipes – annular spaces and noncircular conducts. Natural convection from vertical, inclined and horizontal surfaces.

RADIATION

Introduction – Thermal Radiation – Black body Radiation – Radiation Intensity- Radioactive Properties – Atmospheric and Solar Radiation – View Factor- Simple Problems- Black surfaces and Grey Surfaces – Net Radiation – Heat Transfer in Two and Three Surface Enclosures- Radiation Shield – Problems – Radiation Exchange with Emitting and Absorbing Gases.

BOILING, CONDENSATION AND HEAT EXCHANGERS

Boiling – Types of Boiling- Problems. Condensation – Types of Condensation- Problems.Heat Exchangers- Types- Overall heat transfer co-efficient- Analysis of Heat Exchangers – LMTD method – Effectiveness - NTU Method – Selection of Heat Exchangers – Problems.

LIST OF EXPERIMENTS

1. Determination of Thermal conductivity (Insulating Powder)
2. Determination of Emissivity
3. Determination of Heat transfer co-efficient through Forced Convection
4. Determination of Heat transfer co-efficient through Natural Convection
5. Determination of Heat transfer co-efficient of Pin-Fin Apparatus.
6. Determination of Stefan Boltzmann' s Constant
7. Determination of Thermal conductivity(Two Slabs Guarded Hot Plate Method)
8. Determination of Effectiveness of a Heat Exchanger By Parallel & Counter Flow
9. Determination of Thermal conductivity of the Composite wall.

Text Books

1. YUNUS A CENGEL "Heat Transfer"-Tata Mc Graw Hill–New Delhi.
2. KOTHANDARAMAN C.P "Fundamentals of Heat and Mass Transfer" NewAge International.
3. SACHDEV R C -"Fundamentals of Engineering Heat and Mass Transfer" New Age International

Reference Books

1. OZISIKM.N-"Heat Transfer"-Tata Mc Graw-Hill Book Co.
2. NAGP.K-"Heat Transfer"-Tata Mc Graw-Hill-New Delhi.
3. HOLMANJ.P"Heat and Mass Transfer" Tata Mc Graw-Hill.
4. INCROPRA and DEWITE, Heat Transfer–John Wiley.

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration

1	Heat Transfer	Prof. Sunando DasGupta	IIT Kharagpur	12 weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	R.Anandan	Associate Professor	MECH/VMKVEC	anandan@vmkvec.edu.in
2	C.Thiagarajan	Associate Professor	MECH/AVIT	cthiagarajan@avit.ac.in

	FINITE ELEMENT ANALYSIS	Category	L	T	P	Credit
		CC	3	0	2	4

Preamble

This course provides to learn the basic concepts of finite element analysis (FEA) of solids, structures, fluids and its application in engineering.

Prerequisite : NIL

Course Objective

1	Understand finite element analysis fundamentals and formulations
2	Study the basics of element properties natural, Triangular & rectangular
3	Formulation of finite element methods for Two and three-dimensional solids
4	Formulate the truss, beam and frame problems
5	Formulation of finite element methods for the analysis of heat transfer in solids

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

CO1.	To understand the basic concepts of finite element analysis, node and node numbering methods.	Understand
CO2.	Derive the finite element equations for different mechanical elements. Natural, Triangular & rectangular elements	Apply
CO3.	Formulate and solve problems in 2-D& 3-D structural systemsof solids and their structures.	Apply
CO4.	Identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements	Apply
CO5.	To be able to conduct engineering analysis of basic heat conduction, structural mechanics problems use finite element methods.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO2	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO3	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO4	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO5	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO6	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO7	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-
CO8	S	M	M	M	-	-	-	-	-	-	-	L	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FINITE ELEMENT ANALYSIS

Introduction, Basic Concepts of Finite Element Analysis, Introduction to Elasticity, Steps in Finite Element Analysis. Finite Element Formulation Techniques, Virtual Work and Variational Principle, Galerkin Method, Finite Element Method: Displacement Approach, Stiffness Matrix and Boundary Conditions.

ELEMENT PROPERTIES

Natural Coordinates, Triangular Elements, Rectangular Elements, Lagrange and Serendipity Elements. Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements, Numerical Integration – one dimensional, Numerical Integration: Two and Three Dimensional, Worked out Examples

FEM FOR TWO- AND THREE-DIMENSIONAL SOLIDS

Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements, Numerical Evaluation of Element Stiffness, Computation of Stresses, Geometric Nonlinearity and Static Condensation, Axisymmetric Element, Finite Element Formulation of Axisymmetric Element, Finite Element Formulation for 3 Dimensional Elements, Worked out Examples

ANALYSIS OF FRAME STRUCTURES

Stiffness of Truss Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam, Plane Frame Analysis, Analysis of Grid and Space Frame.

STEADY STATE HEAT TRANSFER ANALYSIS

Basic equations of heat transfer, Axially loaded bar- Heat flow in a bar, Structure of FEA software package.Rate equation: conduction, convection, radiation, energy generated in solid

LIST OF EXPERIMENTS

1. Study of analysis and its benefits
2. Stress analysis of cantilever and simply supported beam
3. Application of distributed loads
4. Nonlinear analysis of cantilever beam
5. Buckling analysis
6. Stress analysis of axis-symmetry vessels
7. Static analysis of two-dimensional truss
8. Transient thermal conduction
9. Conductive heat transfer analysis
10. Plane stress bracket
11. Modal analysis of simply supported beam
12. Harmonic analysis of a cantilever beam

Text Books

1. Hutton, D.V., "Fundamentals of Finite Element Analysis", McGraw Hill, International Edition, 2004.
2. Segerlind, L.J., "Applied Finite Element Analysis", John Wiley & Sons, 1984.

Reference Books

1. Chandrupatla, T.R., Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice HallofIndia, 2002.
2. Zienkiewicz, O.C., "Finite Elements and Approximation", Dover International, 2006.
3. Cook R.D., Malkus, D.S., Plesha, M.E., Witt, R.J., "Concepts and Applications of Finite Element Analysis", 4thEdition, John Wiley & Sons, 2001.
4. H. C. Martin and G. F. Carey, Introduction to Finite Element Analysis - Theory and Application New York, McGraw-Hill

Alternative NPTEL/SWAYAM Course

S.No	NPTEL /SWAYAM Course Name	Instructor	Host Institution	Duration
1	Introduction to Finite Element Analysis	Prof.Nachiketa Tiwari,	IIT Karagpur	12 weeks

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr.S.Prakash	Assistant Professor Gr II	MECH/ AVIT	prakash@avit.ac.in
2	J.Santhos	Assistant Professor	MECH/VMKVEC	santhos@vmkvec.edu.in

	GAS DYNAMICS AND JET PROPULSION	Category	L	T	P	Credit
		CC	3	1	0	4

Preamble

This subject is providing knowledge of insight into the applications of compressible flows and the fundamentals of jet propulsion system. Formulate and solve problems in one -dimensional steady compressible flow including isentropic nozzle flow, constant area flow with friction (Fanno flow) and constant area flow with heat transfer (Rayliegh flow). To enhance the knowledge of determining the change in flow conditions through Prandtl-Meyer expansion wave and characteristic methods to solve problems in two-dimensional compressible flows

Prerequisite – ENGINEERING THERMODYNAMICS

Course Objective

1	To understand the compressible flow fundamentals
2	To analyze the flow through variable area ducts.
3	To study the compressible flow with friction and heat transfer.
4	To know the application of normal shock in compressible flow
5	To study the aircraft propulsion systems and rocket propulsion and its applications

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

CO1.	Understand the basic of compressible flow.	Understand
CO2.	Know to solve flow through variable area ducts.	analyze
CO3.	Know the differences between compressible and incompressible flows.	analyze
CO4.	Solve problems in Rayleigh and Fanno flow.	analyze
CO5.	Understand the knowledge about the rocket propulsion and various propellants.	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	M	L	M	M	M	L							L		
CO2	M	M	L	M	L	L							L		
CO3	S	M	L	M	M	L							L		
CO4	S	S	M	S	M	L							L		
CO5	S	S	S	S	M	L							L		

S- Strong; M-Medium; L-Low

SYLLABUS

COMPRESSIBLE FLOW –FUNDAMENTALS

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

FLOW THROUGH VARIABLE AREA DUCTS

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles.

FLOW THROUGH CONSTANT AREA DUCTS

Flow in constant area ducts with friction (Fanno flow) -Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length.
Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

NORMAL AND OBLIQUE SHOCK

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl –Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock. Flow with Oblique Shock – Fundamental relations, Prandtl"s equation, Variation of flow parameters

PROPULSION

Aircraft propulsion –types of jet engines –study of turbojet engine components –diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines–thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engine, ram jet and pulse jet engines. Rocket propulsion –rocket engines thrust equation –effective jet velocity specific impulse–rocket engine performance, solid and liquid propellants.

Text Books

1	Yahya. S.M., Fundamental of compressible flow with Aircraft and Rocket propulson", New Age International (p) Ltd., New Delhi, 2005.
2	Ganesan. V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 1999.

Reference Books

1	Rathakrishnan. E., "Gas Dynamics", Prentice Hall of India, New Delhi, 2001.
2	Patrich.H. Oosthvizen, William E.Carscallen, "Compressible fluid flow", McGraw-Hill, 1997.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	P.SELLAMUTHU	Associate Professor	MECH / VMKVEC	selsrikanth29@gmail.com
2	R.CHANDRASEKAR	Assistant Professor	MECH / VMKVEC	chandrasekar@vmkvec.edu.in
3.	R. MAHESH	Assistant Professor	MECH / AVIT	mahesh@avit.ac.in

	HYDRAULICS AND PNEUMATIC SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Today, Industries are increasingly demanding process automation in all sectors. Automation results into better quality, increased production and reduced costs. The controlling parameters like motion , Speed, Position and torque are paramount in raising productivity and quality and reducing energy and equipment costs in all industries. Electric drives share most of industrial machine control applications. The variable speed drives which controls speed of a.c/d.c motors are indispensable controlling elements in automation systems. Such drives contains various high performance motors, power electronic converters and digital control systems. With wide options which are open to engineers for selecting proper drive system, one can look forward for a highly efficient and reliable drive for every application in industry.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To understand about basics of fluid power systems fundamentals
2	To acquire knowledge about components used in hydraulic and pneumatic systems
3	To familiarize about the various types of valves and actuators
4	To design hydraulic circuits for different applications
5	To design pneumatic circuits for different applications

COURSE OUTCOMES

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

CO1. Understand the different drive systems and identify which is suitable for specific application.	Understand
CO2. Understand the working of different components in fluid power system.	Understand
CO3. Understand about the utilization of cylinders, accumulators, valves and various control components.	Understand
CO4. Design a feasible hydraulic circuit for a given application.	Apply
CO5. Design a feasible pneumatic circuit for a given application.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	S	M	M	L	M	-							L		
CO2	S	M	M	L	M	-							L		
CO3	S	M	M	L	M	-							L		
CO4	S	S	S	M	L	M							L		
CO5	S	S	S	M	L	M							L		

S- Strong; M-Medium; L-Low

SYLLABUS

FLUID POWER SYSTEMS AND FUNDAMENTALS

Introduction to fluid power, Advantages and Applications of fluid power system. Basic Laws in Fluid power system, Types of fluid power systems, Properties of fluids – General types of fluids – Fluid power symbols. Basic Laws in Fluid power system. Low cost automation.

HYDRAULIC SYSTEM & PNEUMATIC SYSTEMS COMPONENTS

Pump classification – Gear pump, Vane Pump, Piston pump, construction and working of pumps– Variable displacement pumps. Pneumatic Components: Compressors-types. Filter, Regulator, Lubricator Unit, Muffler

VALVES AND ACTUATORS

Construction of Control Components: Director control valve – 3/2 way valve ,4/2 way valve, Shuttle valve ,check valve – pressure control valve –pressure reducing valve, sequence valve-Flow control valve.. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like Telescopic, Cushioning mechanism, Construction of single acting and double acting cylinder.

DESIGN OF HYDRAULIC CIRCUITS

Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, intensifier – Intensifier circuit. Circuits: Reciprocating- Regenerative - Quick return – Sequencing – Synchronizing - Safety circuits - Press – Planer.

DESIGN OF PNEUMATIC CIRCUITS

Fluid Power Circuit Design: Speed control circuits, synchronizing circuit, Sequential circuit design for two and three cylinder using cascade method. Pneumo-hydraulic circuit. Electro pneumatic circuit, Fluid power circuits- failure and troubleshooting.

Text Books:

1. Anthony Esposito - “Fluid Power with Applications”- Pearson Education - 2013
2. Srinivasan - “Hydraulic and Pneumatic Controls”- TMH - 2011.
3. Andrew Parr - “Hydraulics and Pneumatics "- Jaico Publishing House

Reference:

1. Thomson, “Introduction to Fluid power”- Prentice Hall - 2004.
2. Majumdar S.R. - “Oil Hydraulics – Principles and maintenance”- Tata McGraw-Hill.
3. Majumdar S.R. - “Pneumatic systems – Principles and maintenance”- Tata McGraw Hill.

S.No	Name of the Faculty	Designation	Department / Name of the College	Mail ID
01.	Dr.S.Natarajan	Asso.Prof	MECH/ VMKVEC	natarajanshree@gmail.com

	ENGINEERING MECHANICS (Statics and Dynamics)	Category	L	T	P	Credit
		CC	2	1	0	3

Preamble

This course provides the basic knowledge about the behavior of the bodies which are under static and dynamic conditions.

Prerequisite

NIL

Course Objective

1	To explain the basic laws of mechanics and forces
2	To relate the basic concepts and application of rigid bodies under equilibrium in two dimension
3	To employ the concepts of properties of surfaces and to find the Centroid and moment of Inertia using various methods in solid sections.
4	To practice problems in the areas of Friction and Rigid body dynamics by understanding the basic concepts of Friction and Rigid body dynamics.
5	To calculate and categorize of problems in the area of dynamics of particles.

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

CO1.	Identify the engineering problems using the concept of static equilibrium	Understand
CO2.	Solve problems of rigid bodies under equilibrium in two dimension and apply various conditions	Apply
CO3.	Determine the Centroid of a line, areas, and volumes, center of mass of body and moment of inertia of composite areas, mass moment of inertia	Apply
CO4.	Solve problems involving frictional phenomena.	Apply
CO5.	Solve problems in engineering systems using the concept of dynamic equilibrium and analyze the numerical results	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS & STATICS OF PARTICLES

Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem. Parallelogram and triangular law of forces - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces - Principle of transmissibility - Single equivalent force.

EQUILIBRIUM OF RIGID BODIES

Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Moment of a force about a point and about an axis - Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Equilibrium of Rigid bodies in two dimension.

PROPERTIES OF SURFACES AND SOLIDS

Determination of Areas and Volumes - First moment of area the Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - second and product moments of plane area - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Polar moment of inertia - Principle moments of inertia of plane areas - Mass moment of inertia.

FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

Frictional force - Laws of Coloumb friction - simple contact friction - Rolling resistance - Belt friction. Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion.

DYNAMICS OF PARTICLES

Displacement, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy equation of particles - Impulse and Momentum - Impact of elastic bodies.

Text Books

1	Beer & Johnson, Vector Mechanics for Engineers. Vol. I Statics and Vol. II Dynamics, McGraw Hill International Edition, 1995.
2	Kottiswaran N,Engineering Mechanics-Statics & Dynamics,Sri Balaji Publications,2014.
3	Meriam, Engineering Mechanics, Vol. I Statics & Vol. II Dynamics 2/e, Wiley Intl., 1998.

Reference Books

1	Rajasekaran.S, and Sankara Subramanian G, “Engineering Mechanics”, Vikas Publishing Co. New Delhi.
2	Irving H. Sharma, Engineering Mechanics - Statics & Dynamics, III Edition, Prentice Hall of India Pvt. Ltd., 1993.
3	K.L.Kumar, Engineering Mechanics III Edition, Tata McGraw Hill Publishing Co. Ltd., 1998

Course Designers				
S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	J.Sathees Babu	Associate Professor	Mech / VMKVEC	satheesbabu@vmkvec.edu.in
2	Dr. S.Arunkumar	Associate Professor	Mech / VMKVEC	arunkumar@vmkvec.edu.in

PROGRAM SPECIFIC ELECTIVE COURSES

	POWDER METALLURGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble
This course provides basic knowledge in various techniques in Powder Metallurgy. The different methods and procedures are included in the syllabus.

Prerequisite – NIL

Course Objective

1	Classify the different powders and the preparation techniques
2	Perform the characterization of different powders
3	Explain the different powder shaping techniques
4	Explain the sintering processes
5	Apply the techniques for the required applications

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

CO1	Classify powder preparation techniques	Understand
CO2	Identify the characterization techniques for powder	Understand
CO3	Differentiate between conventional powder compaction and modern compaction techniques	Understand
CO4	Explain the mechanism of sintering theory and techniques	Understand
CO5	Apply powder metallurgical techniques for mechanical components	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M		M		M						-	M	-	-
CO2	M	S		S		M						-	M	-	-
CO3	M	S		M		L						-	S	-	-
CO4	L	M		M								-	S	-	L
CO5	M	M		M								-	S	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION (9 Hrs.)

General Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM- Powder Production Techniques: Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes, Performance Evaluation of different Processes, Design & Selection of Process.

CHARACTERISATION (9 Hrs.)

Characterisation Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compressionability, Powder Structure, Chemical Characterization

POWDER SHAPING (9 Hrs.)

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isostatic Pressing, Injection Molding, Powder Extrusion, Slip Casting, Tape Casting, Analysis of Defects of Powder Compact, Laser Engineering Net Shaping (LENS), 3D Printing for Ceramics

SINTERING (9 Hrs.)

Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering, Sintering Variables, Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components

APPLICATIONS (9 Hrs.)

Application of Powder Metallurgy: Filters, Tungsten Filaments, Self-Lubricating Bearings, Porous Materials, Biomaterials etc.

Text Books

1	P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
2	ASM Hand Book, vol. 7: Powder Metallurgy, ASM International.

Reference Books

1	Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
2	J. S. Hirschhorn: Introduction to Powder Metallurgy, American Powder Metallurgy Institute, Princeton, NJ, 1976

Course Designers

S.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	L.PRABHU`	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
2	J.SENTHIL	Associate Professor	Mech / AVIT	jsenthil@avit.ac.in

	ADDITIVE MANUFACTURING IN MEDICAL APPLICATIONS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

The course is designed to impart knowledge and discuss about the role of additive manufacturing in medical applications

Prerequisite – Nil

Course Objective

1	To discuss role of additive manufacturing in medical applications
2	To understand the procedure involved in 3D data capture
3	To identify the scope of bio modeling and virtual models in medicine
4	To identify various biomaterials and its applications
5	To develop the bioimplants and medical devices

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

CO1.	Demonstrate the various additive manufacturing in medical applications	Understand
CO2.	Apply the procedure involved in 3D data capture and processing	Apply
CO3.	Apply various virtual model and bio modeling in medicine	Apply
CO4.	Develop various implants using biomaterials	Apply
CO5.	Able to identify various applications of AM in Medicine	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

3 Dimensional Data Capture and Processing: (9 Hrs.)

Introduction to medical imaging, X-Ray technology, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound imaging, 3-D laser scanners, Industrial CT Scanners, 3D reconstruction and Reverse Engineering (RE)

Bio-modelling and Virtual Models in Medicine: (9 Hrs.)

Surgical applications of virtual models in Cranio-maxillofacial biomodelling, Oral and Maxillofacial surgery, customized cranio- maxillofacial prosthetics, Biomodel-guided stereotaxy, Vascular biomodelling, Skull-base tumour surgery, Spinal surgery and Orthopaedic biomodelling.

Biomaterials: (9 Hrs.)

Introduction to biomaterials, metallic biomaterials, ceramic biomaterials, polymeric biomaterials, composite biomaterials, biodegradable polymeric biomaterials, tissue- derived biomaterials

Design and Fabrication of Customized Implants and Prosthesis: (9 Hrs.)

Cranium implants, Hip implants, Knee implants, Inter vertebral spacers, Buccopharyngeal stent, Tracheobronchial stents, Obturator prosthesis and Tissue engineering scaffolds.

Design and Production of Medical Devices: (9 Hrs.)

Biopsy needle housing, Drug delivery devices, Masks for burnt victims, Functional prototypes help prove design value.

Text Books

1	Ian Gibson, Advanced Manufacturing Technology for Medical Applications, John Wiley, 2005.

Reference Books

1	Paulo Bartolo and Bopaya Bidanda, Bio-materials and Prototyping Applications in Medicine, Springer, 2008.
2	Andreas Gebhardt, Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Hanser Publishers, 2013. Joseph D. Bronzino, The Biomedical Engineering Hand Book, 3rd Edition, CRC Press, 2006.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the	Email id
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
			Mech / VMKVEC	

	RAPID TOOLING & INDUSTRIAL APPLICATIONS	Categor	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

The course is designed to impart knowledge and discuss about the rapid tooling and its industrial applications

Prerequisite – Nil

Course Objective

1	To discuss the basic concepts and techniques in rapid tooling and its process modeling
2	To develop various delivery system involved in AM machines and systems
3	To identify the optical and optoelectronic components used in AM selection Process
4	To identify various controllers used in AM machines and systems
5	To discuss about the rapid tooling equipment systems.

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

CO1.	Demonstrate the various additive manufacturing machines and systems	Understand
CO2.	Apply the procedure involved in designing a delivery system in AM machines and system	Apply
CO3.	Apply optical and optoelectronic components in AM machines and systems	Apply
CO4.	Apply the various controllers in additive manufacturing machines and systems	Understand
CO5.	Able to construct the rapid tooling equipment	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to Rapid Tooling & Process Modeling : (9 Hrs.)

Convectional Tooling Vs. Introduction to modeling, Concurrent Rapid Product and Process Development, Finite Element Modeling and Simulation, Injection-molding, Die-casting, Blow-molding, Thermoforming Processes modeling

Indirect Methods for Rapid Tool Production and Rapid Bridge Tooling: **(9 Hrs.)**

Role of Rapid Soft Tooling methods in tool production, Introduction to Bridge tooling, CAFÉ Bridge tooling, Direct AIM Rapid Bridge tooling, Rapid Tool Rapid Bridge tooling, Shrinkage Variation, Random- noise Shrinkage, Metal deposition tools, RTV tools, Epoxy tools, Ceramic tools, Cast Metal tools, Investment-cast Rapid Production tooling, Fusible metallic cores, Rapid Production tooling for Precision Sand Casting, Keltool process.

Direct Method for Rapid Tool Production: (9 Hrs.)

Role of direct methods in tool production, Direct ACES Injection moulds, Laminated Object Manufactured (LOM) tools, DTM Rapid Tool, Rapid Steel 1.0, Rapid Steel 2.0, Copper Polymide tools, Sand Form tools, EOS Direct Tool Process, Direct Metal Tooling using 3DP, Topographic Shape Formation (TSF) tools.

The Role of Rapid Tooling in Investment-Casting & Sand Casting Applications: (9 Hrs.)

Introduction, Rapid Tool Making for investment Casting, Rapid Tooling for developing Casting Applications, Sand casting Process, Tool Design and Construction for Sand Casting, Sand Casting Dimensional Control, Tooling Alternative Selection Case Studies

Rapid Tooling in the Medical Device & Automotive Industry (9 Hrs.)

Introduction, Investment Casting and Conventional Wax Pattern Tooling, Conventional Tooling Manufacture Vs. Rapid Tooling Manufacture, Medical Case studies like Hip Stem and Knee implants. Approaching Niche Vehicle Markets, Accelerating Product Developments, Utilizing Rapid Prototyping and Manufacturing, Machining Laminates, Rapid Prototype Stages, Subsequent Casting Operations, Rapid Tooling Developments, Case Studies.

Text Books

1	D.T. Pham and S.S Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping & Rapid Tooling, Springer, 2001.
2	Peter Hilton and Paul F Jacobs, Rapid Tooling Technologies and Industrial Applications, Marcel Dekker Inc, New York, 2001

Reference Books

1	Wanlong Wang, Henry W. Stoll and James G. Conley, Rapid Tooling Guidelines for Sand Casting, Springer, 2010.
2	Andreas Gebhardt, Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Hanser Publishers, 2013.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the**	**Email id**
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
			Mech / VMKVEC	

	POLYMER ENGINEERING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble
This course provides basic knowledge in various Polymerisation techniques and application in engineering domain in specific to the 3D printing and design

Prerequisite – NIL

Course Objective

1	Explain the different polymers and their properties
2	Explain the mechanism of polymerisation
3	Explain the different methods of polymerization
4	Explain the polymer processes for additive manufacturing
5	Explain the designing concepts of polymeric devices and polymer additives

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

CO1	Explain the relationship between polymer properties (thermal, rheological, mechanical), and polymer microstructure and molecular weight.	Understand
CO2	Relate polymer properties to their processing and uses for additive	Understand
CO3	Explain methods for determining the microstructure and molecular weight of polymers.	Understand
CO4	Describe different types of polymerization process, polymer processing and the significance for AM.	Understand
CO5	Understand the applications and design concepts for use of polymer in device manufacturing.	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	M	M	M		M	M				M	M	-	M	-	-
CO2	M	S	S		S	M				M	M	-	M	-	-
CO3	S		M		S		M			M	M	-	S	-	-
CO4	M		M	S	M			M		M	M	-	S	-	-
CO5	M	M	M	M	M			M		M	M	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION (9 Hrs.)
Basic Concepts: Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD], various methods of determination of MWD.
KINETICS AND MECHANISM (9 Hrs.)
Polymerization Kinetics Free radical polymerization, Mechanism of Polycondensation
POLYMERISATION (9 Hrs.)
Techniques of Polymerization and nano composites: Techniques of polymerization, bulk, emulsion, suspension, Polymer composites and nano-composites
POLYMER PROCESSING (9 Hrs.)
Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques and the effect of these processing techniques on polymer structure,
DESIGN (9 Hrs.)
Designing of polymeric devices and polymers used for Additive: Aspects of designing polymeric devices and polymer additives, Polymers used for additive manufacturing : polyamide, PF resin, polyesters etc

Text Books	
1	G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4th
2	V.R. Gowarikar Polymer Science, , New Age Int.
Reference Books	
1	F.W. Billmeyer Jr Text book of Polymer Science, Inter science Publisher John Wiley and Sons, 3rd edition

Course Designers

S.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	L.PRABHU`	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
2	J.SENTHIL	Associate Professor	Mech / AVIT	jsenthil@avit.ac.in

	3D PRINTING AND DESIGN	Categor	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

The course is designed to impart knowledge and skills related to 3D printing technologies,

Prerequisite – Computer Integrated Manufacturing

Course Objective

1	To discuss the basic concepts and procedure followed in 3D printing methods
2	To construct a CAD model for a required product
3	To identify the use of different material and support structures
4	To experiment with different 3d printing process
5	To identify the defects.

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

CO1.	Demonstrate the various 3D Printing methods	Understand
CO2.	Develop CAD Models ,Import and Export CAD data and generate .STL file.	Apply
CO3.	Select a specific material for the given application.	Apply
CO4.	Select a 3D printing process for an application.	Apply
CO5.	Able to identify the Product defects after post processing	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	M	L	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	S	S	M	-	M	-	-	-	-	-	-	-	M	-	-
CO3	M	M	L	L	L	-	-	-	-	-	-	-	M	-	-
CO4	S	M	-	-	M	-	-	-	-	-	-	-	M	-	-
CO5	M	S	M	M	-	-	-	-	-	-	-	-	L	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

3D PRINTING & CAD FOR ADDITIVE MANUFACTURING (7 Hrs.)

Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications. CAD Data formats, Data translation, Data loss, STL format.

ADDITIVE MANUFACTURING TECHNIQUES (12Hrs.)

Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, HealthCare, Defence, Automotive, Construction, Food Processing, Machine Tools

MATERIALS (8 Hrs.)

Polymers, Metals, Non-Metals, Ceramics. Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties.
Support Materials

ADDITIVE MANUFACTURING EQUIPMENT (10 Hrs.)

Process Equipment- Design and process parameters, Governing Bonding Mechanism
Common faults and troubleshooting, Process Design

POST PROCESSING & PRODUCT QUALITY (8 Hrs.)

Post Processing Requirement and Techniques , Product Quality Inspection and testing , Defects and their causes

Text Books

1	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies:Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2	Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.

Reference Books

1	CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
2	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3	J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the**	**Email id**
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
			Mech / VMKVEC	

	INTEGRATED PRODUCT DESIGN AND DEVELOMENT	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

The course is designed to impart knowledge about the procedure and design criteria followed while developing a product

Prerequisite – Nil

Course Objective

1	To discuss the basic concepts and techniques in Additive Manufacturing Processes
2	To develop a design for additive manufacturing processes
3	To identify the guidelines to be followed in AM selection Process
4	To identify various Additive manufacturing applications
5	To discuss about the post processing procedure in Additive Manufacturing Processes.

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

CO1.	Demonstrate the various additive manufacturing processes	Understand
CO2.	Apply the procedure involved in designing an additive manufacturing process	Apply
CO3.	Understand and apply the guidelines while selecting a AM process	Apply
CO4.	Understand the various application of additive manufacturing process	Understand
CO5.	Able to identify the post processing procedure in AM processes	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	M	L	-	-	-	-	-	-	-	-	-	-	M	-	M
CO 2	S	S	M	-	L	-	-	-	-	-	-	-	L	-	L
CO 3	M	M	-	-	M	-	-	-	-	-	-	-	L	-	M
CO 4	M	M	-	-	L	-	-	-	-	-	-	-	L	-	L
CO 5	M	L	M	M	-	-	-	-	-	-	-	-	M	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

Modern Product development, process tools and design theories: (9 Hrs.)

Understanding the opportunity, Develop a concept, Implement a concept, Reverse engineering and redesign methodology, Product development teams, Planning Process, Planning and scheduling tools.

Understanding customer needs & Establishing product function (9 Hrs.)

Kano diagram of customer satisfaction, Prioritising Customer needs, Function analysis system technique, Function structure. Product tear down and experimentation: Tear down process, methods, applications, Post teardown reporting. Benchmarking and establishing engineering specifications

Product Portfolios and portfolio Architecture, Generating concepts and concept selection: (9 Hrs.)

Portfolio architecture types and choice, Product modularity, Clustering, Information gathering, Brainstorming, TRIZ, Morphological Evaluation, Concept selection Process, Numerical Concept scoring.

Concept embodiment, Modelling of Product metrics: (9 Hrs.)

System modelling and embodiment principles, Modelling approaches and case studies. Design for the environment: DFE methods, Life cycle assessment, Techniques to reduce environmental impact.

Analytical and Numerical model solutions: (9 Hrs.)

Simulation and optimization techniques, Design for robustness: Robust Design model construction, methods

Text Books

1	Kevin N. Otto, Kristin L. Wood, Product Design, Pearson Education, 2004.
2	W. Ernest Eder, S. Hosendl., Design Engineering, CRC Press, 2008.

Reference Books

1	Gahl, W Beitz J Feldhusun, K. G. Grote, Engineering Design, 3rd Edition, Springer 2007.
2	Ali K. Kamrani and Emad Abouel Nasr, "Engineering Design and Rapid Prototyping", Springer, 2010.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
			Mech / VMKVEC	

	MANUFACTURING CONTROL AND AUTOMATION	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

The course is designed to impart skill and knowledge manufacturing control and automation.

Prerequisite – Nil

Course Objective

1	Understand the fundamentals of automation, when and where to apply them.
2	Identify various material handling systems and automation systems.
3	Apply various control systems in manufacturing and evaluate automatic production
4	Design an optimal circuit for automation.
5	Use modeling and simulation for manufacturing automation.

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

CO1.	Understand the fundamentals of automation, when and where to apply them.	Understand
CO2.	Identify various material handling systems and automation systems.	Apply
CO3.	Apply various control systems in manufacturing and evaluate automatic production	Apply
CO4.	Analyze an optimal circuit for automation.	Apply
CO5.	Use modeling and simulation for manufacturing automation.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction: (9 Hrs.)
Automation in production system principles and strategies of automation, basic Elements of a automated system. Advanced Automation functions. Levels of Automations, introduction to automation productivity.
Material Handling System & Automated Manufacturing Systems: (9 Hrs.)
Over view of Handling system-Rotary feeders, oscillating force feeder, vibratory feeder, elevator type and Transport system storage system, Components of automation, line balancing, manufacturing cells & transfer mechanism. Fundamentals and analysis of transfer lines product design for automatic assembly.
Control Technologies in Automation: (9 Hrs.)
Industrial control system. Process industry vs Discrete manufacturing industries. Continuous vs discrete control. Continuous process and its forms, Sensors and Actuators. Other control system components. Supervisory Production Control and Management Systems, Evaluation of Automatic Production Product manufacturability. Orientation devices- active and passive devices, Parts orientation and Escapement.
Pneumatic and Hydraulic Components and Circuits: (9 Hrs.)
Pneumatic sensors and amplifiers. Jet destruction devices, Logic devices, Schmit triggering devices, developing pneumatic circuits for automatic die casting machine.
Modeling and Simulation for Manufacturing Plant Automation: (9 Hrs.)
Introduction. Need for system modeling. Building mathematical model of a manufacturing plant. Modern tools in manufacturing automation, Robots and Application of Robots for

Text Books

1	Mikell P Groover, Automation, Production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
2	Tiess Chiu Chang and Richard A.W., An Introduction to Automated Process Planning Systems, TMH, New Delhi, 2000.

Reference Books

1	Nanua Singh, System Approach to Computer Integrated Manufacturing, Wiley & Sons Inc., 1996.
2	Andrew Kusiak, Intelligent Manufacturing System, Prentice Hall Inc., New Jersey, 1992.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	L.Prabhu	Associate Professor	Mech / AVIT	prabhu@avit.ac.in
			Mech / VMKVEC	

17MEEC11	ROBOTICS BASED INDUSTRIAL AUTOMATION	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE

To introduce the concepts of automation in Various Industrial applications

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand robotics based industrial automation
2	To Identify the various automated assembly systems
3	To develop automated material handling and storage system
4	To identify the various automated inspection and testing methods.
5	To build the automated manufacturing systems.

COURSE OUTCOMES

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

CO1.	Understand the basics of Industrial Automation	Understand
CO2.	Construct various automated assembly systems	Apply
CO3.	Construct the automated material and storage systems.	Apply
CO4.	Demonstrate automated inspection and Testing methods	Apply
CO5.	Construct the automated manufacturing systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PSO 1	PSO2	PSO3
CO1	M	M	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	L	S	M	-	M	-	-	-	-	-	-	-	S	-	-
CO3	M	M	M	L	M	-	-	-	-	-	-	-	S	-	-
CO4	S	M	M	L	M	M	-	-	-	-	-	-	S	-	-
CO5	S	S	M	L	M	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION & FIXED AUTOMATION: (9 Hrs.)

Definition, automation principles and strategies, scope of automation, low cost automation Production concepts and automation strategies. Automated Flow lines, Methods of Work part Transport, Transfer Mechanism - Continuous transfer, intermittent transfer, and Indexing mechanism, Buffer Storage, Control Functions and Automation for Machining Operations. Analysis of Transfer Lines without Storage, Partial Automation, Automated Flow Lines with Storage Buffers.

AUTOMATED ASSEMBLY SYSTEMS:(9 Hrs.)

Design for Automated Assembly, Types of Automated Assembly Systems, Vibratory bowl feeder and Non vibratory bowl feeder, Part Orienting Systems, Feed tracks, Escapements and part placing mechanism, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine.

AUTOMATED MATERIAL HANDLING & STORAGE SYSTEM:(9 Hrs.)

The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Storage System Performance, Automated Storage/Retrieval Systems, Carousel Storage Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing.

AUTOMATED INSPECTION AND TESTING: (9 Hrs.)

Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

MODELING OF AUTOMATED MANUFACTURING SYSTEMS:(9 Hrs.)

Role of Performance Modeling, Performance Measures, Performance Modeling Tools: Simulation Models, Analytical Models.

TEXT BOOKS:

1	Mikell P.Grover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education Asia, 2001.
2	C.RayAsfahl, "Robots and manufacturing Automation", John Wiley and Sons New York, 1992.

REFERENCES:

1	N.Viswanadham and Y.Narahari, "Performance Modeling of Automated Manufacturing Systems", Prentice Hall India Pvt. Ltd, 1992.
2	Stephen J. Derby, "Design of Automatic Machinery", Special Indian Edition, Marcel Decker, New York, Yesdee publishing Pvt. Ltd, Chennai, 2004.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department / Name of the College	Mail ID
1	R.PRAVEEN	Assistant Professor G-II	Mechanical, AVIT	Praveen@avit.ac.in

17MEEC11	AUTOMATION IN MANUFACTURING	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE : To introduce the concepts of automation in Various Industrial applications

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand robotics based industrial automation
2	To Identify the various automated assembly systems
3	To develop automated material handling and storage system
4	To identify the various automated inspection and testing methods.
5	To build the automated manufacturing systems.

COURSE OUTCOMES

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

CO1.	Understand the basics of Industrial Automation	Understand
CO2.	Construct various automated assembly systems	Apply
CO3.	Construct the automated material and storage systems.	Apply
CO4.	Demonstrate automated inspection and Testing methods	Apply
CO5.	Construct the automated manufacturing systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

MECHATRONIC SYSTEMS: (6 Hrs.)

Overview of mechatronic systems and devices in manufacturing, automated feeding, transfer, retrieval mechanisms and devices, AGVs, FMS workstations, material handling and storage systems, overview of sensors, transducers and control systems in manufacturing.

HYDRAULIC SYSTEMS: (10 Hrs.)

Hydraulic systems: flow, pressure and direction control valves, actuators, supporting and control elements, pumps, servo valves and actuators, electro hydraulic servo- valves, proportional valves and their applications, design of hydraulic circuits for mfg applications and performance analysis.

PNEUMATIC SYSTEMS: (10 Hrs.)

Production, distribution and conditioning of compressed air, system components and graphic representations, design of circuits-switching circuits and sequential circuits, cascade methods, step counter method, compound circuit design.

ROBOTICS IN AUTOMATION: (12Hrs.)

Robot classification and anatomy, forward and inverse kinematics, DH matrix transformation, Jacobian and differential motion, Trajectory planning, Static and dynamic analysis, applications in manufacturing.

PLCS AND MICROPROCESSORS: (7 HRS.)

Basic structure - Input / Output processing - Programming - Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC, Programming and interfacing of microprocessors in manufacturing applications.

TEXT BOOKS:

1	Mikell P.Grover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education Asia, 2001.
2	C.RayAsfahl, "Robots and manufacturing Automation", John Wiley and Sons New York, 1992.

REFERENCES:

1	N.Viswanadham and Y.Narahari, "Performance Modeling of Automated Manufacturing Systems", Prentice Hall India Pvt. Ltd, 1992.
2	Stephen J. Derby, "Design of Automatic Machinery", Special Indian Edition, Marcel Decker, New York, Yesdee publishing Pvt. Ltd, Chennai, 2004.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department / Name of the College	Mail ID
1	R.PRAVEEN	Assistant Professor G-II	Mechanical, AVIT	Praveen@avit.ac.in
2				

17MEEC11	PRODUCT DESIGN FOR MANUFACTURING AND ASSEMBLY	Category	L	T	P	Credit
		EC(PS)	3	0	0	3

PREAMBLE: To introduce the concepts of automation in Various Industrial applications

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand robotics based industrial automation
2	To Identify the various automated assembly systems
3	To develop automated material handling and storage system
4	To identify the various automated inspection and testing methods.
5	To build the automated manufacturing systems.

COURSE OUTCOMES

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

CO1.	Understand the quality aspects of design for manufacture and assembly.	Understand
CO2.	Apply Boothroyd method of DFM for product design and assembly.	Apply
CO3.	Apply the concept of DFM for casting, welding, forming and assembly.	Apply
CO4.	Identify the design factors and processes as per customer specifications.	Apply
CO5.	Apply the DFM method for a given 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	S	M	-	-	S	-	-	-	-	-	-	-	M	-	-
CO2	M	S	M	-	M	-	-	-	-	-	-	-	L	-	L
CO3	S	S	M	L	M	-	-	-	-	-	-	-	M	-	M
CO4	M	M	M	L	L	M	-	-	-	-	-	-	M	-	M
CO5	S	M	L	L	L	-	-	-	-	-	-	-	M	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

Introduction to DFM, DFMA: (9 Hrs.)

How Does DFMA Work?, Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design?, Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

High speed Automatic Assembly & Robot Assembly: (9 Hrs.)

Design of Parts for High-Speed Feeding and Orienting, Additional Feeding Difficulties, High-Speed Automatic Insertion, General Rules for Product Design for Automation, Design of Parts for Feeding and Orienting, Product Design for Robot Assembly.

Design for Machining and Injection Molding: (9 Hrs.)

Machining Using Single-Point & Multi point cutting tools, Choice of Work Material, Shape of Work Material, Machining Basic Component Shapes, Cost Estimating for Machined Components, Injection Molding Materials, The Molding Cycle, Injection Molding Systems, Molding Machine Size, Molding Cycle Time, Estimation of the Optimum Number of Cavities, Design Guidelines.

Design for Sheet Metal working & Die Casting: (9 Hrs.)

Dedicated Dies and Press-working, Press Selection, Turret Press working, Press Brake Operations, Design Rules, The Die Casting Cycle, Auxiliary Equipment for Automation, Determination of the Optimum Number of Cavities, Determination of Appropriate Machine Size, Die Casting Cycle Time Estimation, Die Cost Estimation, Design Principles.

Design for Assembly Automation: (9 Hrs.)

Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated *as*sembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, single station assembly lines.

TEXT BOOKS:

1	Geoffrey Boothroyd, Assembly Automation and Product Design, Marcel Dekker Inc., NY, 3rd Edition,2010.
2	Geoffrey Boothroyd, Hand Book of Product Design, Marcel Dekker Inc., NY, 1992.

REFERENCES:

1	. GeofferyBoothroyd, Peter Dewhurst and Winston Knight,A, "Product Design for Manufacture and Assembly", CRC Press, 2011.
2	.KarlUlrich,T, Steven Eppinger, D, "Product Design and Development", McGrawHill, 2015.

COURSE DESIGNERS

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1	R.PRAVEEN	Assistant Professor G-II	Mechanical, AVIT	Praveen@avit.ac.in

	AUTOMOTIVE CHASSIS	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

A chassis is the internal framework of an artificial object, which supports the object in its construction and use. An example of a chassis is a vehicle frame, the under part of a motor vehicle, on which the body is mounted; if the running gear such as wheels and transmission, and sometimes even the driver's seat, are included, then the assembly is described as a rolling chassis.

Prerequisite

Nil

Course Objectives

1. To apply the concept of entire process involved in vehicle frame and steering systems.
2. To perform the application of propeller shaft and final drive
3. To employ the concepts of axles and tyres.
4. To perform the application of Suspension System.
5. To apply the concepts of braking system in automotive chassis

Course Outcomes

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

CO1. Summarize Automotive chassis and its accessories.	Understand
CO2. Utilize the applications of final drive	Apply
CO3. Apply the knowledge of axles and tyres.	Apply
CO4. Utilize the applications of Suspension System.	Apply
CO5. Develop the concepts of braking 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
1.	S	M	M	M	-	-	-	-	-	-	-	M	L	-	-
2.	S	M	M	M	-	-	-	-	-	-	-	M	L	-	-
3.	S	M	M	M	-	-	-	-	-	-	-	M	L	-	-
4.	S	M	M	M	-	-	-	-	-	-	-	M	L	-	-
5.	S	M	M	M	-	-	-	-	-	-	-	M	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION, FRAME, STEERING SYSTEM

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

PROPELLER SHAFT AND FINAL DRIVE

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

AXLES AND TYRES

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

SUSPENSION SYSTEM

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

BRAKING SYSTEM

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Leading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Hydraulic, Mechanical, Pneumatic and Power–Assisted Braking System, Servo Brakes, Retarders, Anti–Lock Braking System.

TEXT BOOK:

1. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2012.
2. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2015.
3. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007.

REFERENCES:

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hezler, Modern Vehicle Technology, Butterworth, London, 2005.

Course Designers:

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	VEHICLE TRANSPORT MANAGEMENT	Category	L	T	P	C
		SE	3	0	0	3

Preamble

This course reviews the methods of training and training procedure in the transport management, scheduling and fare structure of various public and private and state government undertaking vehicles , maintenance and motor vehicle act

Prerequisite

Nil

Course Objectives

1	To provide an insight on the different procedures of selecting persons for job and personnel management
2	To inculcate the various aspects of incorporating and managing a transportation system.
3	To elucidate on the calculation of costs of transportation, fare fixation and scheduling.
4	To provide the rules and regulations of transport system as per motor vehicle act of India.
5	To inculcate the aspects of maintenance of automotive vehicles.

Course Outcomes:

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

CO1.	Appraise on the various aspects of personnel management of a transport system.	Understand
CO2.	Devise a transport system for a typical town with proper systems for effective operations.	Apply
CO3.	Construct a fair table and prepare a schedule for a typical transportation system,	Apply
CO4.	Appraise on the various rules and regulations of transport system as per motor vehicle act of India.	Apply
CO5.	Develop a perfectly applicable maintenance schedule for an automotive.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION
Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.
TRANSPORT SYSTEMS
Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. Chain of responsibility forms of ownership by state, municipality, public body and private undertakings
SCHEDULING AND FARE STRUCTURE
Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling
MOTOR VEHICLE ACT
Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.
MAINTENANCE
Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

TEXT BOOK:
1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
REFERENCES:
1. Government Motor Vehicle Act, Publication on latest act to be used as on date

CourseDesigners:

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	ENGINE AND VEHICLE MANAGEMENT SYSTEM	Category	L	T	P	C
		SE	3	0	0	3

Preamble

To study and purpose is to understand engine management system

Prerequisite

NIL

Course Objectives

1	To understand the fundamentals of automotive electronics in details.
2	To understand the types sensors
3	To impart knowledge on SI engine management system.
4	To impart knowledge on CI engine management system.
5	To understand the vehicle management systems

Course Outcomes:

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

CO1.	Summarize the vehicle motion control and stabilization system	Understand
CO2.	Classify Driver assistance, security and warning system	Understand
CO3.	Apply safety concepts used in passenger cars	Apply
CO4.	Identify vehicle collision and its effects.	Apply
CO5.	Apply Safety and comfort 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	M	M	M	--	--	--	M	--	--	--	M	M	--	--
CO2	S	M	M	M	--	--	--	M	--	--	--	M	M	--	--
CO3	S	S	S	M	--	--	--	M	--	--	--	M	M	--	--
CO4	S	S	S	M	--	--	--	M	--	--	--	M	M	--	--
CO5	S	S	S	M	--	--	--	M	--	--	--	M	M	--	--

S- Strong; M-Medium; L-Low

Syllabus

FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS
Microprocessor architecture, open and closed loop control strategies, PID control, Look up tables, Introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI enignes and in the other parts of the automobile
SENSORS
Inductive, Hall effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, air mass flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors
SI ENGINE MANAGEMENT
Three-way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control. Electronic ignition systems and spark timing control. Closed loop control of knock.
CI ENGINE MANAGEMENT
Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve
VEHICLE MANAGEMENT SYSTEMS
ABS system, its need, layout and working. Electronic control of suspension – Damping control, Electric power steering, Supplementary Restraint System of air bag system – crash sensor, seat belt tightening. Cruise control. Vehicle security systems- alarms, vehicle tracking system. On board diagnostics. Collision avoidance Radar warning system.

TEXT BOOK:
1. William B Ribbens "Understanding Automotive Electronics", SAE Publications, 1998
2. Eric Chowanietz "Automobile Electronics" SAE Publications, 1994
REFERENCES:
1. Robert Bosch "Diesel Engine Management" SAE Publications, 2006
2. Robert Bosch, "Gasoline Engine Management" SAE Publications, 2006.

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	VEHICLE MAINTENANCE	Category	L	T	P	C
		SE	3	0	0	3

Preamble

To study and purpose is to understand various vehicle maintenance

Prerequisite

Nil

Course Objectives

1	To understand the maintenance of records and schedules.
2	To understand the engine maintenance and repair and overhauling.
3	To understand the chassis maintenance and repair and overhauling
4	To impart the various electrical system maintenance service and repairs.
5	To understand the various maintenance of cooling, fuel, lubrication and body.

Course Outcomes:

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

CO1.	Summarize vehicle maintenance records and schedule	Understand
CO2.	Explain repair and overhauling of engine	Understand
CO3.	Apply maintenance, repair and overhauling of chassis drive line components	Apply
CO4.	Identify maintenance, repair and servicing of electrical systems	Apply
CO5.	Conduct maintenance, repair and servicing of cooling lubrication system, fuel system and body	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

MAINTENANCE OF RECORDS AND SCHEDULES
Importance of maintenance, preventive (scheduled) and breakdown (unscheduled) maintenance, requirements of maintenance, preparation of check lists. Inspection schedule, maintenance of records, log sheets and other forms, safety precautions in maintenance..
ENGINE MAINTENANCE – REPAIR AND OVERHAULING
Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up
CHASSIS MAINTENANCE - REPAIR AND OVERHAULING
Mechanical and automobile clutch and gear box, servicing and maintenance, maintenance servicing of propeller shaft and differential system. Maintenance servicing of suspension systems. Brake systems, types and servicing techniques. Steering systems, overhauling and maintenance. Wheel alignment, computerized alignment and wheel balancing.
ELECTRICAL SYSTEM MAINTENANCE - SERVICING AND REPAIRS
Testing methods for checking electrical components, checking battery, starter motor, charging systems, DC generator and alternator, ignitions system, lighting systems. Fault diagnosis and maintenance of modern electronic controls, checking and servicing of dash board instruments.
MAINTENANCE OF FUEL SYSTEM, COOLING SYSTEMS, LUBRICATION SYSTEM AND VECHICLE BODY
Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts. Vehicle body maintenance, minor and major repairs. Door locks and window glass actuating system maintenance

TEXT BOOK:
1. John Doke "Fleet Management", McGraw-Hill Co. 1984
2. Venk Spicer, "Automotive Maintenance and Trouble Shooting".
REFERENCES:
1. James D Halderman - Advanced Engine Performance Diagnosis – PHI - 1998
2. Judge.A.W., "Maintenance of high speed diesel engines",Chapman Hall Ltd., London.

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	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	Category	L	T	P	Credit
		SE	3	0	0	3

Preamble

Automotive electrical and electronic systems used in road vehicles, enable study analyze and apply the concepts of various electrical and electronics component such as battery alternator ignition system and other engine management systems.

Prerequisite

Nil

Course Objectives

1. To perform the concepts of battery and charging systems..
2. To compilet the knowledge of starting systems in the vehicle.
3. To employ the knowledge in the application of various types of charging system & lighting system.
4. To demonstrate the application and knowledge of fundamental of automotive electronics.
5. To employ the application and knowledge of sensors and actuators.

Course Outcomes

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

CO1. Outline the concepts of Electrical and Electronics System	Understand
CO2. Summarize the various concept of starting systems.	Understand
CO3. Apply the various types of charging system & lighting system.	Apply
CO4. Identify the application automotive electronics.	Apply
CO5. Compare the sensors and actuators.	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
1.	S	M	M	L	-	-	-	-	-	-	-	L	L	-	-
2.	S	M	M	L	-	-	-	-	-	-	-	L	L	-	-
3.	S	S	S	M	-	-	-	-	-	-	-	M	L	-	-
4.	S	S	S	M	-	-	-	-	-	-	-	M	L	-	-
5.	S	S	S	M	-	-	-	-	-	-	-	M	L	-	-

S- Strong; M-Medium; L-Low

Syllabus

BATTERIES

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods. Details of modern storage batteries.

STARTING SYSTEM

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units. Care & maintenance of starter motor, Starter switches.

CHARGING SYSTEM & LIGHTING SYSTEM

Generation of direct current, shunt generator characteristics, armature reaction,third brush regulation, cutout. Voltage and current regulators, compensatedvoltage regulator, alternators principle and constructional aspects and bridgerectifiers, new developments.Lighting system: insulated and earth return system, details of head light and sidelight, LED lighting system, head light dazzling and preventive methods – Horn,wiper system and trafficator.

FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

Current trends in automotive electronic engine management system, electromagnetic interference suppression, electromagnetic compatibility, electronic dashboard instruments, onboard diagnostic system, security and warning system.

SENSORS AND ACTUATORS

Types of sensors: sensor for speed, throttle position, exhaust oxygen level,manifold pressure, crankshaft position, coolant temperature, exhaust temperature,air mass flow for engine application. Solenoids, stepper motors, relay.

TEXT BOOK:

1. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 2004.
2. Judge,A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 2004.
3. Younng A.P & Griffiths L, "Automobile Electrical and Electronic Equipments", English Languages Book Society & New Press.
4. Tom Weather Jr and Cland C.Hunter, "Automotive Computers and Control system", Prentice Hall Inc., New Jersey.

REFERENCES:

1. Vinal,G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985.
2. Crouse,W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
3. Spreadbury,F.G., Electrical Ignition Equipment, Constable & Co. Ltd., London, 1962.
4. Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003.

Course Designers:

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	ENERGY CONSERVATION IN THERMAL SYSTEMS	Category	L	T	P	CREDIT
			3	0	0	3

Preamble

This course is intended to introduce principles of energy auditing and to provide measures for energy conservation in thermal utilities

Prerequisite

NIL

Course Objectives

1	To provide him the present energy scenario and the need for energy conservation.
2	To understand energy monitoring / targeting aspects of Energy
3	To study the different measures for energy conservation and financial implications of various thermal utilities.
4	To study the different measures of energy conservation in thermal systems.
5	To provide energy conservation measures of different thermal utilities.

Course Outcomes

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

CO1	Understand the energy sources and scenario.	Understand
CO2	Understand energy monitoring / targeting aspects of Energy	Analysis
CO3	To apply the measures for energy conservation and financial implications of various thermal utilities.	Apply
CO4	To apply the concepts and performance study of different types of corrosion	Apply
CO5	Performance analysis of thermal utilities	Analysis

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION
Indian Energy Scenario – Types & Forms of Energy - Primary / Secondary Energy Sources – Energy Conservation – Need – EC Act 2003 : Salient Features – Energy Intensive Industries – Barriers - Roles & Responsibility of Energy Managers – Energy Auditing : Preliminary & Detailed - Benchmarking.
ENERGY MONITORING & TARGETING
Data & Information Analysis – Cost / Energy Share Diagram – Data Graphing – Break Even Analysis – Depreciation – Financial Analysis Techniques – CUSUM Technique – ESCO Concept – ESCO Contracts.
PERFORMANCE STUDY OF THERMAL UTILITIES – 1
Boiler – Stoichiometry – Combustion Principles – Heat Loss Estimation – Steam Traps – Steam Piping & Distribution – Thermic Fluid Heaters – Furnaces – Insulation & Refractories
PERFORMANCE STUDY OF THERMAL UTILITIES – 2
Introduction- forms of corrosion-pitting, intergranular, stress corrosion, corrosion fatigue, dezincification, erosion-corrosion, Crevice Corrosion, Fretting-Protection methods-PVD, CVD.
PERFORMANCE STUDY OF THERMAL UTILITIES – 3
Basics of R & A/C – COP / EER / SEC Evaluation – Psychometric Chart Analysis – Types & Applications of Cooling Towers – Basics – Performance Analysis – DG Set – Performance Prediction– Cost of Power Generation – Scope for Energy Conservation in all these
Text Books:
1 Smith, CB Energy Management Principles, Pergamon Press, NewYork, 1981 2 Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980 3 Trivedi, PR, Jolka KR, Energy Management, Commonwealth Publication, New Delhi, 1997
Reference:
1. Write, Larry C, Industrial Energy Management and Utilization, Hemisphere Publishers, Washington, 1988 2. Diamant, RME, Total Energy, Pergamon, Oxford, 1970 3. Handbook on Energy Efficiency, TERI, New Delhi, 2001 4. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)

Course Designers:

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2		
3		

	HYDROGEN AND FUEL CELL TECHNOLOGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

PREAMBLE

To enlighten on various technological advancements, benefits and prospects of utilizing hydrogen/fuel cell for meeting the future energy requirements.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To detail on the hydrogen production methodologies, possible applications and various storage options.
2	To discuss on the working of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics.
3	To analyze the cost effectiveness and eco-friendliness of Fuel Cells.
4	To make students understand the different fuel cells and their applications.
5	To enable students to understand the economics of fuel cells.

COURSE OUTCOMES

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

CO1. Know the hydrogen production methodologies and various storage options	Understand
CO2. Know the working of fuel cell and its types with thermodynamic performance.	Understand
CO3. Understand the cost effectiveness and eco-friendliness of fuel cells.	Understand
CO4. Know the different types of fuel cells and their applications.	Understand
CO5.Understand the economics of fuel cells.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO4	PO 5	PO6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PSO3
CO1	M	S	S	S	S	S	S						L		
CO2	S	S	S	M	M	M	L						L		
CO3	M	L	--	--	M	M	S						L		
CO4	S	M	M	--	M	M	M						L		
CO5	M	L	--	--	L	L	L						L		

S- Strong; M-Medium; L-Low

SYLLABUS

HYDROGEN – BASICS AND PRODUCTION TECHNIQUES: Hydrogen – physical and chemical properties, salient characteristics. Production of hydrogen – steam reforming – water electrolysis – gasification and woody biomass conversion – biological hydrogen production – photo dissociation – direct thermal or catalytic splitting of water.

HYDROGEN STORAGE AND APPLICATIONS: Hydrogen storage options – compressed gas – liquid hydrogen – Hydride – chemical Storage – comparisons. Safety and management of hydrogen. Applications of Hydrogen.

FUEL CELLS: History – principle - working - thermodynamics and kinetics of fuel cell process – performance evaluation of fuel cell – comparison on battery Vs fuel cell.

FUEL CELL – TYPES: Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits.

APPLICATION OF FUEL CELL AND ECONOMICS: Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space. Economic and environmental analysis on usage of Hydrogen and Fuel cell. Future trends in fuel cells**.**

TEXT BOOKS:

1. Viswanathan, B and M Aulice Scibioh, Fuel Cells – Principles and Applications, Universities Press (2006)
2. Rebecca L. and Busby, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Corporation, Oklahoma (2005
3. Bent Sorensen (Sørensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, UK (2005)

REFERENCES:

1. Kordesch, K and G.Simader, Fuel Cell and Their Applications, Wiley-Vch, Germany (1996)
2. Hart, A.B and G.J.Womack, Fuel Cells: Theory and Application, Prentice Hall, New York Ltd., London (1989)
3. Jeremy Rifkin, The Hydrogen Economy, Penguin Group, USA (2002).

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department / Name of the College	Mail ID
1	SHIVAKUMAR N	Asst. Prof. - II	Mechanical, AVIT	shiva.thermal@gmail.com

	RENEWABLE SOURCE OF ENERGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

Renewable source of energy are developing fast throughout the world, and their combination is increasingly able to meet the needs for available, agreeable, and affordable energy, also for the people that lack access to energy today. In addition, local energy resources are not hit by the high energy price increases that are threatening to reverse the progress in providing energy to the poor people that lack appropriate energy today. This is why sustainable energy, the combination of renewable energy and energy efficiency, is increasingly become a part of the efforts to reduce poverty.

Prerequisite - NIL

Course Objective

1	To understand the importance of solar energy.
2	To learn the importance of wind energy.
3	To know the importance of bio energy.
4	To know various renewable energy power plants.
5	To learn the necessity of latest and modern energy sources.

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

CO1.	To apply the solar radiation , measurements of solar radiation and solar thermal collectors	apply
CO2.	To apply wind data ,energy estimation and wind energy conversion systems	apply
CO3.	To apply the Biomass directs Combustion, Biomass gasifier and Biogas plant.	apply
CO4.	To apply the Wave energy ,Open and closed OTEC Cycles and Small hydro plant turbines	apply
CO5.	To apply the power generation, transport , Fuel cells and its technologies	apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PS O3
CO1	M	M	M	-	-	-	-	-	-	-	-	-	M		
CO2	S	M	M	-	-	-	-	-	-	-	-	-	M		
CO3	S	M	M	-	-	-	-	-	-	-	-	-	M		
CO4	S	M	M	M	-	-	-	-	-	-	-	-	M		
CO5	S	M	M	M	-	-	-	-	-	-	-	-	M		

S- Strong; M-Medium; L-Low

SYLLABUS

SOLAR ENERGY

Solar Radiation – Measurements of solar Radiation – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications

WIND ENERGY

Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy-Generators and its performance – Wind Energy Storage – Applications – Hybrid systems

BIO – ENERGY

Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct Combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio Diesel production and economics.

OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY

Tidal energy – Wave energy –Open and closed OTEC Cycles – Small hydro plant turbines – Geothermal energy sources- environmental issues.

NEW ENERGY SOURCES

Hydrogen generation, storage, transport and utilization, Applications - power generation- transport – Fuel cells – technologies, types – economics and the power generation

Text Books

1	G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.
2	S.P. Sukhatme, "Solar Energy", Tata McGraw Hill Publishing Company Ltd., New Delhi,1997.

Reference Books

1	Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 1996
2	Twidell, J.W. & Weir, A., "Renewable Energy Sources", EFN Spon Ltd., UK, 1986
3	G.N. Tiwari, "Solar Energy Fundamentals Design, Modelling and applications", Narosa Publishing House, New Delhi, 2002
4	L.L. Freris, "Wind Energy Conversion systems", Prentice Hall, UK, 1990

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Raja.s	Assistant Professor	MECH / VMKVEC	raja_slm3@yahoo.co.in

	WASTE ENERGY CONVERSION TECHNOLONGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This subject deals with various techniques involved in waste treatment, waste disposal and how to convert energy from that waste. Detailed study extends to the method of thermo chemical and bio chemical conversion techniques. Also deals a case study of environmental and health impact due energy conversion to waste.

Prerequisite - NIL

Course Objective

1	To understand the waste and waste processes.
2	To understand waste treatment and disposal.
3	To apply how to convert waste to energy from thermo chemical conversion.
4	To apply how to convert waste to energy from bio chemical conversion.
5	To analysis the environmental impact due to waste with case study.

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

CO1.	Explained types of waste and source of waste	understand
CO2.	Understand various waste treatment and disposal	understand
CO3.	Apply the various techniques to convert waste to energy by thermo chemical conversion.	apply
CO4.	Apply various methods to convert waste to energy from bio chemical conversion.	apply
CO5.	Analysis the environmental and health impacts due to waste with case study.	analysis

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO WASTE & WASTE PROCESSING

Definitions, sources, types and composition of various types of wastes; Characterisation of Municipal SolidWaste (MSW) , Industrial waste and Biomedical Waste (BMW), waste collection and transportation; waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), recycling processes of solid waste.

WASTE TREATMENT AND DISPOSAL

Aerobic composting, incineration, different type of incineration; medical and pharmaceutical waste incinerations- land fill classification, types, methods and sitting consideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases.

ENERGY FROM WASTE-THERMO CHEMICAL CONVERSION

Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting,-environmental and health impacts of incineration; strategies for reducing environmental impacts.

ENERGY FROM WASTE- BIO-CHEMICAL CONVERSION

Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion- biogas production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages.

ENVIRONMENTAL AND HEALTH IMPACTS-CASE STUDIES

Environmental and healthimpacts of waste to energy conversion, case studies of commercial waste to energy plants,waste to energy- potentials and constraints in India, eco-technological alternatives for waste to energy conversions - Rules related to the handling, treatment and disposal of MSW and BMW in India.

Text Books

1	Parker, Colin, & Roberts, "Energy from Waste An Evaluation of Conversion Technologies", Elsevier Applied Science, London, 1985.
2	Shah, Kanti L., "Basics of Solid & Hazardous Waste Management Technology", Prentice Hall, 2000.

Reference Books

1	Robert Green, From Waste to Energy, Cherry Lake Publication, 2009.
2	Velma I Grover and Vaneeta Grover, "Recovering Energy from Waste Various Aspects", Science Pub Inc, 2002.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	R.CHANDRASEKAR	Assistant Professor	MECH / VMKVEC	chandrasekar@vmkvec.edu.in

	COMBUSTION ENGINEERING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

On completion of this course, the students are able to understand the concepts of combustion of fuel and flames. Also students are able to get the knowledge on consequence of various combustions.

Prerequisite

ENGINEERING THERMODYNAMICS

Course Objective

1	To Acquire the fundamental knowledge of combustion.
2	To Understand the thermodynamics of combustion.
3	To Understand the kinetics of combustion.
4	To Understand the types of flames.
5	To Understand the combustion aspects in SI and CI Engines.

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

CO1.	Formulate combustion equations to determine A/F, adiabatic flame temperature and pollutant concentration.	Apply
CO2.	Relate the thermo chemistry and kinetics of combustion to evolve mathematical models for combustion.	Analyze
CO3.	Rate of physical mixing and its effects on ignition, propagation and extinction, and rate of chemical reaction once mixed.	Understand
CO4.	Identify factors responsible for laminar and turbulent flame propagation. Apply the different principles of flame stabilization and ignition to design combustor.	Apply
CO5.	Summarize emission associated with combustion and identify their control techniques	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	S	S	M	M	-	-	L	-	-	-	L	-	L		
CO2	S	S	M	-	-	-	-	-	-	-	L	-	L		
CO3	S	M	M	M	-	-	-	-	-	-	L	-	L		
CO4	S	S	M	L	-	-	M	-	-	-	M	-	L		
CO5	L	M	M	S	-	M	S	-	-	-	M	-	L		

S- Strong; M-Medium; L-Low

SYLLABUS

COMBUSTION OF FUEL
Introduction - Combustion equations - Theoretical air - Excess air - Air fuel ratio - Equivalence ratio - Exhaust gas composition - Air fuel ratio from exhaust gas composition - Heating value of fuels.
COMPRESSION IGNITION ENGINES
Thermo-chemistry, first law analysis of reacting systems - Adiabatic combustion temperature - Second law analysis of reacting systems - Criterion for chemical equilibrium - Equilibrium constant for gaseous mixtures - Evaluation of equilibrium composition - Chemical availability
KINETICS OF COMBUSTION
Rates of reaction - Reaction order and complex reactions - Chain Reactions, Arrhenius rate equation, collection theory - Activated complex theory - Explosive and general oxidative characteristics of fuels.
FLAMES
Laminar and turbulent flames - Premixed and diffusion flames - Burning velocity and its determination - Factors affecting burning velocity - Quenching, flammability and ignition - Flame stabilization in open burners
ENGINE COMBUSTION
Combustion in SI and CI engines - Stages of combustion in SI and CI engines - Normal combustion and abnormal combustion - Emissions from premixed combustion - Emission from non-premixed combustion - Control of emissions

Text Books

1	Ganesan.V, "Internal Combustion Engines", Tata McGraw-Hill, New Delhi.
2	Ramalingam.K.K, "Internal Combustion Engines - Theory and practice", SciTech Publications India Pvt. Ltd., Chennai, 2010.
3	Stephen.R.Turns, "An Introduction to Combustion concepts and applications", McGraw Hill Book Company, Boston, 3rd Edition, 2011.

Reference Books

1	Thipse.S.S, "Internal Combustion Engines", Jaico Publication House.
2	Thipse.S.S, "Alternate Fuels", Jaico Publication House.
3	Heywood.J.B, "Internal Combustion Engine Fundamentals", McGraw Hill International, New York.
4	Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons.
5	Domkundwar.V.M, "A course in Internal Combustion Engines", Dhanpat Rai & Sons.

Course Designers

S.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	S.PRAKASH	Assistant Professor (Gr-II)	Mech / AVIT	prakash@avit.ac.in

	COMPUTATIONAL FLUID DYNAMICS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This course introduces the finite difference methods as a means of solving different type of differential equations that arise in fluid dynamics. Fundamentals of numerical analysis, ordinary differential equations and partial differential equations related to fluid mechanics and heat transfer will be reviewed. Error control and stability considerations are discussed and demonstrated.

Prerequisite

1. Engineering Thermodynamics
2. Fluid Mechanics And Machinery

Course Objective

1	To understand basic properties of computational methods
2	To introduce Governing Equations of viscous fluid flows
3	To learn computational solution techniques for time integration of ordinary differential equations
4	To introduce numerical modeling and its role in the field of fluid flow and heat transfer
5	To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.

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

CO1.	Discuss the basic properties of computational methods	Understand
CO2.	Discuss the Governing Equations of viscous fluid flows	Understand
CO3.	Solve problems in computational solution techniques for time integration of ordinary differential equations	Analyze
CO4.	Solve problems in numerical modeling and its role in the field of fluid flow and heat transfer	Analyze
CO5.	Determine the various discretization methods, solution procedures and turbulence modeling.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	S	M	M	L	M	L	-	-	-	-	-	L	L	-	-
CO2	S	M	M	L	L	L	-	-	-	-	-	-	L	-	L
CO3	S	M	M	L	L	L	-	-	-	-	-	L	L	-	L
CO4	S	S	S	M	L	L	-	-	-	-	-	-	L	-	L
CO5	M	M	M	L	L	M	-	-	-	-	-	-	L	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Computational Fluid Dynamics, Advantages, Applications, Future of CFD. Problem set up-pre-process, Numerical solution – CFD solver
GOVERNING EQUATIONS FOR CFD
Introduction, the continuity equation, the momentum equation, the energy equation, the additional equations for turbulent flows, generic form of the governing equations for CFD, boundary conditions.
CFD TECHNIQUES
Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy- Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems
FLOW FIELD ANALYSIS
Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.
TURBULENCE MODELS AND MESH GENERATION
Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

Text Books	
1	Versteeg, H.K., and Malalasekera, W.,"An Introduction to Computational Fluid Dynamics": The finite volume Method, Pearson Education Ltd. Third Edition – 2014.
2	Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd.,
Reference Books	
1	John D. Anderson "Computational Fluid Dynamics - The basics with Applications", McGrawHill International Editions.
2	Anil W. Date, "Introduction to Computational Fluid Dynamics", Cambridge University Press, Reprinted 2010.
3	Yogesh Jaluria & Kenneth E. Torrance, "Computational Heat Transfer", CRC press, 2nd Edition.
4	John. F. Wendt, "Computational Fluid Dynamics – An Introduction", Springer, Third Edition, 2013.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	S.PRAKASH	Assistant Professor (Gr-II)	Mech / AVIT	prakash@avit.ac.in
2				

	CRYOGENIC ENGINEERING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This course provides basic knowledge of cryogenic refrigeration systems, cryogenic instrumentation and cryogenic heat exchangers

Prerequisite

ENGINEERING THERMODYNAMICS

Course Objective

1	To provide the knowledge of evolution of low temperature science
2	To provide knowledge on the properties of materials and gas separation systems
3	To familiarize with various vacuum techniques systems
4	To provide design aspects of cryogenic storage and transfer lines
5	To provide the knowledge of advances in cryogenics

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

CO1.	Understand properties of material at cryogenic temperatures	Understand
CO2.	To understand the properties of materials and gas separation systems	Understand
CO3.	Know about various vacuum techniques systems	Apply
CO4.	To understand the cryogenic refrigeration systems	Understand
CO5.	Understand the cryogenic instrumentation and cryogenic heat exchangers	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	S	L		M			L					L	L		
CO2	S	M									L	L	L		
CO3	S	M					M					M	L		
CO4	S	M		M			L				S	M	L		
CO5	S	M		S	M		L				S	M	L		S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO CRYOGENIC SYSTEMS

Properties of materials at low temperature, Properties of Cryogenic Fluids - Air and Gas Liquefaction Systems: Thermodynamically ideal system, Production of low temperatures
Liquefaction systems for gases other than Neon, Hydrogen and Helium, liquefaction systems for Neon, Hydrogen and Helium - Cryogenic Refrigeration System

GAS SEPARATION AND GAS PURIFICATION SYSTEMS

The thermodynamically ideal separation system properties of mixtures, Principles of gas separation, air separation systems, Hydrogen, Argon, Helium air separation systems, Gas purification methods.

VACUUM TECHNIQUES

System for production of high vacuum such as mechanical, diffusion, ion and cryopumps - Cryogenics measurement systems - Temperature pressure, flow rate, liquid level measurement, Introduction to Cryo-coolers.

CRYOGENIC FLUID STORAGE SYSTEMS

Introduction, Basic Storage vessels, inner vessel, outer vessel design, piping, access manways, safety device.Cryogenic insulations Vacuum insulation, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated lines, vacuum insulated lines, porous insulated lines etc.

ADVANCES IN CRYOGENICS

Vortex tube and applications, Pulse tube refrigerator, Cryogenic Engine for space vehicles. Cryogenic Applications in gas industry, cryogenic fluids, space research, Cryobiology, food processing, electronics, nuclear and high energy physics, chemical processing, metal manufacturing, cryogenic power generation, medicine, analytical physics and chemistry.

Text Books

1	Cryogenic Systems – R.F. Barron
2	Cryogenic Engineering – R.B. Scott – D.Van Nostrand Company, 1959

Reference Books

1	Cryogenic Process Engineering – K.D. Timmerhaus and T.M. Flynn, Plenum Press, New York, 1989
2	High Vacuum Technology – A. Guthree – New Age International Publication
3	Experimental Techniques in Low Temperature Physics – G.K. White – Oxford University Press, England, 1959

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Dr.M.Prabhahar	Asso Prof	Mech / AVIT	mprabhahar@avit.ac.in

	POWER PLANT ENGINEERING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

Power Plant Engineering is the subject involving study of applying the thermal engineering concepts and machineries in the process of power generation. Power Plants are the backbone of a country involving in the generation of electric power.

Prerequisite - Thermal Engineering

Course Objective

1	To understand the objectives of power plants in a country's electrical power requirement.
2	To understand the operational methods of power generation using different energy sources.
3	To provide the knowledge of instrumentation involved in the operation and control of power plants
4	To estimate the cost and economics of power generation in different types of power plants.
5	To inculcate the knowledge of environmental impact of power plants on the society.

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

CO 1.	Understand the methods of power generation using different energy sources	Understand
CO 2.	To state the instrumentation and control systems for a power plant	Understand
CO 3.	To calculate the cost of power generation for a typical power plant	Apply
CO 4.	To infer the environmental impacts of power plants on the society	Apply
CO 5.	Prepare a layout for different power plants	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	M	M	S	-	-	-	-						M	M	M
CO2	S	M	M	M	M	-	-						M	S	M
CO3	M	S	S	S	-	-	-						M	M	S
CO4	M	S	S	S	M	M	S						M	M	S
CO5	S	S	S	S	S	S	-						M	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Power Generation: Global Scenario, Present status of power generation in India, Role of private and governmental organizations, Load shedding, Carbon credits, Power reforms, concept of cascade efficiency.

General layout of modern power plant with different circuits, working of thermal power plant, coal classification, coal, ash and dust handling, selection of coal for Thermal Power Plant, FBC boilers, high pressure boiler, cogeneration power plant (with numerical)

Steam Condenser: Necessity of steam condenser, Classification, Cooling water requirements, Condenser efficiency, Vacuum efficiency, Cooling towers, air Leakage, Effects of Air Leakage on condenser performance, (Numerical Treatment)

HYDROELECTRIC AND NUCLEAR POWER PLANTS

HEPP : Introduction, Plant Layout, Site Selection, Advantages and Disadvantages of HEPP, Hydrograph , Flow duration curve ,Mass Curve, Classification of HEPP with layout.

NPP : Elements of NPP, Nuclear reactor & its types, fuels moderators, coolants, control rod, classification of NPP, N-waste disposal

DIESEL & GAS TURBINE POWER PLANT

DEPP : Plant Layout, Diesel Engine Power Plant Performance Analysis, application, selection of engine size, advantages & disadvantages of diesel power plant.

GTPP : Introduction, fuels, materials selection for GTPP, Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Actual cycle effect of operating variables on thermal efficiency, inter-cooling reheating, & regeneration cycle, Open, Closed & Semi Closed cycles Gas Turbine Plant , combined cycle plant (Numerical Treatment).

NON-CONVENTIONAL POWER PLANTS

Wind Power plant : Introduction, wind availability measurement, types of wind machines, site selection, and wind power generation.

Solar Power Plant : Introduction, components ,Types of Collectors & Solar Ponds, Low & High Temperature Solar Power Plant. Photovoltaic Power System, Heliostat

Tidal, OTEC, geothermal, magneto hydrodynamics, fuel cell, hybrid power plants, Challenges in commercialization of Non-Conventional Power Plants.

INSTRUMENTATION , ECONOMICS AND ENVIRONMENTAL IMPACT

Power Plant Instrumentation Layout of electrical equipment, generator, exciter, short circuits & limiting methods, switch gear, circuit breaker, power transformers, methods of earthing, protective devices & Control system used in power plants, Control Room.

Economics of Power Generation: Introduction, Cost of electric energy, Fixed and operating cost, (with

numerical treatment), Selection and Type of generation, Selection of generation equipment, Performance and operation characteristics of power plants and Tariff methods.

Environmental impact due to power plants. Environmental aspects, introduction, constituents of atmosphere, different pollutants due to thermal power plants and their effects of human health, Environmental control of different pollutant such as particulate matter, Oxides of sulphur, nitrogen, global warming & green house effect, thermal pollution of water & its control. Noise pollution by power plants.

Text Books

1	E.I.Wakil, ―Power Plant Engineering‖, McGraw Hill Publications New Delhi
2	P.K.Nag, ―Power Plant Engineering‖, McGraw Hill Publications New Delhi
3	K K Ramalingam ,‖ Power Plant Engineering, SCITECH Publications Pvt Ltd.
4	Domkundwar & Arora, ―Power Plant Engineering‖, Dhanpat Rai & Sons, New Delhi

Reference Books

1	R.K.Rajput, ―Power Plant Engineering‖, Laxmi Publications New Delhi
2	R.Yadav , ―Steam and Gas Turbines‖ ,Central Publishing House, Allahabad
3	G.D.Rai, ― Non-Conventional Energy Sources‖ Khanna Publishers,Delhi
4	S.P.Sukhatme, ―Solar Energy‖ Tata McGraw-Hill Publications, New Delhi

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	N.Lakshminarayanan	Associate Professor	MECH / AVIT	nlakshminarayanan@avit.ac.in
2	K.Surendar Babu	Associate Professor	MECH / AVIT	surendrababu@avit.ac.in

	REFRIGERATION AND AIR CONDITIONING	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble
This course provides the underlying principles of operation in different Refrigeration & Air conditioning systems and components.

Prerequisite
NIL

Course Objective

1	To impart knowledge on refrigeration cycles and methods to improve performance
2	To familiarize the components of refrigeration systems
3	To Perform psychrometric calculations
4	To introduce air conditioning systems
5	To know the applications of refrigeration and air conditioning systems

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

CO1.	Carry out analysis of refrigeration cycles	Understand
CO2.	Understand the principles refrigeration of air-conditioning and basic design considerations.	Understand
CO3.	Perform psychrometric calculations, humidity control and analysis of air-conditioning processes	Apply
CO4.	Apply the concepts of indoor environmental comfort.	Apply
CO5.	Know the various applications of Refrigeration and air conditioning	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	S	L		L			L					L	L		
CO2	S	M										L	L		
CO3	S	S	M	M									M		
CO4	S	S	M	M									M		
CO5	S	M		M	M		L					M	L		

S- Strong; M-Medium; L-Low

SYLLABUS

REFRIGERATION CYCLE

Review of thermodynamic principles of refrigeration. Carnot refrigeration cycle – Vapour compression refrigeration cycle – use of P.H. charts – multistage and multiple evaporator Systems – cascade system – COP comparison. Air Refrigeration cycles.

REFRIGERANTS AND SYSTEM COMPONENTS

Compressors – reciprocating and rotary (elementary treatment), Types of condensers, vaporators, cooling towers – Functional aspects. Refrigerants – properties – selection of refrigerants, Alternate Refrigerants, Cycling controls.

PSYCHROMETRY

Psychrometric processes use of psychrometric charts – Grand and Room Sensible Heat Factors – bypass factor – air washers, requirements of comfort air conditioning, summer and Winter Air conditioning.

AIR CONDITIONING SYSTEMS

Cooling load calculation working principles of – Centralized Air conditioning systems, Split, Ductable split, Packaged Air conditioning, VAV & VRV Systems. Duct Design by equal friction method, Indoor Air quality concepts.

UNCONVENTIONAL REFRIGERATION CYCLES

Vapor Absorption system – Ejector jet, Steam jet refrigeration, thermo electric refrigeration. APPLICATIONS – ice plant – food storage plants – milk – chilling plants.

Text Books

1	Manohar Prasad, "Refrigeration and Air Conditioning", Wiley Eastern Ltd., 1983.
2	Arora C.P., "Refrigeration and Air Conditioning", Tata McGraw Hill, New Delhi, 1988.

Reference Books

1	Roy. J. Dossat, "Principles of Refrigeration", Pearson Education 1997.
2	Jordon and Priester, "Refrigeration and Air Conditioning", Prentice Hall of India Pvt.Ltd., New Delhi, 1985.
3	Stoecker N.F. and Jones, "Refrigeration and Air Conditioning", TMH, New Delhi,1981.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Dr.M.Prabhahar	Assoc Prof	Mech / AVIT	mprabhahar@avit.ac.in
2				

	TURBOMACHINERY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble
This course is to explore the strategies in Machineries and its dynamic analysis

Prerequisite
Engineering Thermodynamics, Fluid Mechanics and Machinery

Course Objective

1	To learn the principles of fluid machinery.
2	To understand various fans and blowers.
3	To understand the concept of compressors.
4	To learn the concept of axial flow compressors.
5	To understand the concept of various turbines.

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

CO1.	Know about the fundamental of fluid mechanics concepts, and energy transfer from fluid and machineries	Remember
CO2.	To understand the design concepts and importance of dynamic machineries	Understand
CO3.	To understand about constructional details of compressors and performance analysis from graphs	Understand
CO4.	To know about bench marking and to utilize velocity diagrams for work done, efficiency and performance characteristics	Apply
CO5.	To know about bench marking and to utilize velocity diagrams for blade design, testing and analysis	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC PRINCIPLES

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless Parameters-specific speed-applications-stage velocity triangles-work and efficiency

CENTRIFUGAL FANS AND BLOWERS

Types- stage and design parameters-flow analysis in impeller blades-volute and Diffusers, losses, characteristic curves and selection, fan drives and fan noise.

CENTRIFUGAL COMPRESSOR

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and Performance curves

AXIAL FLOW COMPRESSOR

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work Done simple stage design problems and performance characteristics.

AXIAL AND RADIAL FLOW TURBINES

Stage velocity diagrams, reaction stages, losses and coefficients, blade design Principles, testing and performance characteristics

Text Books

1	Yahya, S.M., Turbines, Compressors and Fans, Tata McGraw-Hill Publishing Company, 1996.
2	Ganesan, V., Gas Turbines, Tata McGraw Hill Pub. Co., 1999.

Reference Books

1	Bruneck, Fans, Pergamom Press, 1973.
2	Shepherd, D.G., Principles of Turbo machinery, Macmillan, 1969.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Mr.R.Mahesh	Asst.Prof Gr-II	Mech / AVIT	Mahesh@avit.ac.in

	DESIGN OF THERMAL POWER EQUIPMENTS	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble
This course provides knowledge of design and analysis of the heat exchangers.

Prerequisite
NIL

Course Objective

1	To provide the knowledge of heat transfer equipment.
2	To provide knowledge on design and analysis of the Shell and tube heat exchanger
3	Enable to carry out the performance of heat exchanger with the extended surfaces.
4	To provide design and analysis of cooling towers.

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

CO1.	Design and analysis of the parallel flow, counter flow heat exchangers.	Understand
CO2.	To understand the multi-pass and cross flow heat exchangers.	Understand
CO3.	To develop the Shell and tube heat exchanger.	Apply
CO4.	To optimize the performance of heat exchanger	Understand
CO5.	To design and analyze the cooling towers	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	S	L		M			L						L		
CO2	S	M											L		
CO3	S	M					M						L		
CO4	S	M		M			L						L		
CO5	S	M		S	M		L						L		S

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION OF HEAT EXCHANGERS

Introduction, Recuperation & Regeneration – Tubular heat exchangers: double pipe, shell & tube heat exchanger, Plate heat exchangers.

BASIC DESIGN METHODS OF HEAT EXCHANGER

Introduction, Basic equations in design, Overall heat transfer coefficient – LMTD method for heat exchanger analysis – parallel flow, counter flow, multi-pass, cross flow heat exchanger design calculations.

SHELL & TUBE HEAT EXCHANGERS

Tube layouts for exchangers, baffle Heat exchangers, calculation of shell and tube heat exchangers – shell side film coefficients, Shell side equivalent diameter, the true temperature difference in a 1-2 heat exchanger, shell side pressure drop, tube side pressure drop, Analysis of performance of 1-2 heat exchanger, and design calculation of shell & tube heat exchangers.

CONDENSATION OF SINGLE VAPORS AND EXTENDED SURFACES

Evaporators and Reboilers, Vaporizing processes, forced circulation vaporizing exchangers, natural circulation vaporizing exchangers, calculations of a reboiler.
Longitudinal fins, calculation of a double pipe fin efficiency curve, calculation of a double pipe finned exchanger.

DIRECT CONTACT HEAT EXCHANGER

Cooling towers, relation between wet bulb & dew point temperatures, classification of cooling towers, cooling tower internals, Heat balance, heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements. Calculation of cooling tower performance.

Text Books

1	Process Heat Transfer – D.Q. Kern, TMH.
2	Heat Exchanger Design – A.P.Fraas and M.N. Ozisick. John Wiely & sons, New York.

Reference Books

1	W.F. Stoecker, Design of Thermal Systems - McGraw-Hill
2	Bejan, G. Tsatsaronis, M.J. Moran, Thermal Design and Optimization – Wiley
3	N.V. Suryanarayana, Design & Simulation of Thermal Systems – MGH.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Mr. N. Fedal Castro	Asst Prof - II	Mech / AVIT	fedal@avit.ac.in

	HEAT EXCHANGERS FUNDAMENTALS , DESIGN AND ANALYSIS	Category	L	T	P	Credit
			3	0	0	3

Preamble

Heat Exchangers are systems used in most of the conventional and non-conventional power plants around the world for transferring heat from one source of energy into another for the purpose of power generation. Power and energy are the significant elements of everyday scenario in the world and heat exchangers are one of the most important equipments applied everywhere. This course provides a deep knowledge of design, construction and analysis of heat exchangers for a thorough understanding for every graduating mechanical engineer.

Course Objective

1	To inculcate a thorough knowledge on the fundamentals of heat exchangers and its applications.
2	To provide thorough procedure for design of shell and tube heat exchangers.
3	To provide thorough design procedure of condensers.
4	To detail on the different types of compact heat exchangers, heat pipes and its applications.
5	To detail on the methods and means of analysing heat exchangers for stresses occurring during its working .

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

CO1.	Select a suitable type of heat exchanger for an application duly analysing the different requirements .	Analyze
CO2.	Design a shell and tube heat exchanger with reference to a particular type of application.	Apply
CO3.	Design a condenser for an industrial application .	Apply
CO4.	Appropriately choose a type of compact heat exchanger for an heat transfer equipment.	Analyze
CO5.	Analyse a designed heat exchanger for suitability in a preferred application.	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	M	M	M	S	S	-	S	S	-	-	-	-	L	-	-
CO2	M	M	S	S	S	-	S	S	L	-	-	L	L	-	-
CO3	M	M	S	S	S	-	S	S	L	-	-	L	L	-	-

CO4	M	M	M	S	S	-	S	S	-	-	-	-	L	-	-
CO5	M	M	M	S	S	-	S	S	-	-	-	L	L	-	-
S- Strong; M-Medium; L-Low															

SYLLABUS

FUNDAMENTALS OF HEAT EXCHANGERS

Review of heat transfer modes and governing laws and equations. Introduction to heat exchangers - purpose, usage and applications of heat exchangers. Principles and methods of working of heat exchangers, Classification of heat exchangers – based on process function, flow arrangements, design, and based on applications. Recuperative and Regenerative heat exchangers.

Parameters for basic design of heat exchanger - overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multi-pass and cross-flow heat exchanger, e-NTU method for heat exchanger analysis, TEMA code, J-factors.

DESIGN OF SHELL AND TUBE HEAT EXCHANGERS

Shell and Tube heat exchanger for single phase heat transfer – types , features of shell and tube heat exchanger, thermal design considerations, fouling considerations, selection of fluids for tube and shell side, process design procedure, problems on design of shell and tube heat exchanger.

DESIGN OF CONDENSERS

Shell and tube heat exchanger for two phase heat transfer – physical mechanism of condensation, types of condensers, condenser design, de-superheating and sub-cooling. Reboiler – types and application.

COMPACT HEAT EXCHANGERS & HEAT PIPES

Enhancement of heat transfer compact heat exchangers, extended surface heat transfer, extended surface heat exchangers, performance evaluation of heat transfer enhancement technique, pinch analysis. Finned tube heat exchanger, plate fin heat exchanger, pressure drop and multi stream analysis, phase change heat exchangers.

Heat Pipes, heat pipe heat exchangers. Regenerators, Fixed bed regenerator analysis, design and simulation of regenerator, Problems in fixed bed regenerator. Micro heat exchanger – introduction, Micro scale heat transfer, micro channel, micro heat exchanger.

ANALYSIS OF HEAT EXCHANGERS

Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses – types of failure, buckling of tubes, flow induced vibration. Heat exchanger network synthesis, heat exchanger testing.

Reference Books

1	Dutta B.K. „Heat Transfer-Principles and Applications", PHI Pvt. Ltd., New Delhi, 1st ed. 2006.
2	D. Q. Kern, Process Heat Transfer, McGraw-Hill Book Company, Int. ed. 1965.
3	John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation", Elsevier science Ltd, 2001.
4	Indian Standard (IS: 4503-1967): Specification for Shell and Tube Type Heat Exchangers, BIS 2007, New Delhi.

Course Designer

Faculty Name	Designation	Department/Name of the College	Email id
N.LAKSHMINARAYANAN	ASSOCIATE PROFESSOR	MECH/AVIT	nlakshminarayanan@avit.ac.in

INNOVATION & ENTREPRENEURSHIP, SKILL DEVELOPMENT COURSES

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

PREAMBLE:

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

PREREQUISITE: Not Required

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. G. Murugesan	Professor	Management Studies	murugesan@vmkvec.edu.in
2	Mr. T. Thangaraja	Assistant Professor	Management Studies	thangaraja@avit.ac.in

	PROJECT MANAGEMENT FOR ENGINEERING BUSINESS AND TECHNOLOGY	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE: Engineering Project Management is a type of Project Management, focuses solely on engineering and Management. Similar to other Project Management it posses standard methodologies and processes with engineering background. It enables to get into the field of Project Management. These skills can provide critical benefits such as improved efficiency, enhanced effectiveness, success replication, perfect leadership and communication, and complete view of the project in the aspect of time and cost.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the importance of Project Management.
2. To understand the Project management Techniques.
3. To understand the statistical process control.
4. To impart the various Project management tools and software.
5. To understand the Project management and resource utilization.

COURSE OUTCOMES:

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

CO1: Understand the importance of Project Management and Business.	Understand
CO2: Explain the required tools to implement Project Techniques.	Apply
CO3: Analyze various Project constraints with help of project tools.	Analyze
CO4: Evaluating various Project Techniques.	Analyze
CO5: Put forward the Project management in a different organization milieu.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

Project Management concept-Attributes as a project-Project life cycle-The Project Management process-Benefits of Project Management- Needs, Identification-Project selection-preparing a request for proposal-Soliciting proposals-Proposed solutions- Proposal Marketing-Bid/No-Bid Decision-Developing Winning Proposal-Proposal preparation-Proposal contents-Pricing Consideration-Proposal Submission and Follow-up - Customer evaluation as proposals-Types of contracts-Contract provisions.

PROJECT PLANNING

Project Planning-Project Planning Objective-Work Break-down structure-Responsibility Matrix-Defining activities-Developing the network plan-Planning for Information system development- -Scheduling-activity duration estimates-project start and finish times-Schedule calculation-Scheduling for information systems development.

PROJECT CONTROL PROCESS

Schedule control-Project control process-Effects of actual schedule performance - Incorporating project changes into schedule-Updating the project schedule-Approaches to schedule control-Schedule control for information system development – Resource consideration-Constrained Planning-Planned resources utilization – Resources levelling- Limited scheduling-Project Management software – Cost Planning and Performance - Project cost Estimates-Project Budgeting-Determining actual cost-Determining the value of work performed-Cost performance analysis-Cost forecasting-Cost control-Managing Cash Flow.

RISK AND FEASIBILITY

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

PROJECT MANAGER SKILLS AND ABILITIES

Project Manager-Responsibilities of the Project Manager-Skills at the Project Manager - Developing the skill needed to be a Project Manager-Delegation-Managing Change – Project Team-Project Team development and Effectiveness- Ethical Behaviour conflict on project-problem solving-Time Management-Project Communication and Personal Communication-Effective listening-Meetings-Presentation-Report-Project documentation and Controlling changes-Types of project organization- Matrix organization.

TEXT BOOKS:

1. Samuel J.Mantel JR., Jack R.Meredith, Project Management, Wiley India, Edition 2006.
2. Santakki.V.C., Project Management, Himalaya Publishing House, Edition 2006.

REFERENCES:

1. Project Management, Jack Gido and James P Clements, (Edition 2009) Cenage Learning India pvt Ltd., New Delhi.

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	mail id
1	B. Rajnarayanan	Assistant Professor	Management Studies	rajsachin.narayanan@gmail.com
2	Dr. V.Sheelamary	Asso.Professor	Management Studies	sheelamary@avit.ac.inn

	INTELLECTUAL PROPERTY RIGHTS AND ALTERNATE DISPUTE RESOLUTION	Category	L	T	P	Credit
			3	0	0	3

PREAMBLE: IPR & ADR

Intellectual Property Rights are valuable assets and most important for any kind of business because set the business apart from competitors, offer customers something new and different, be sold or licenced form an essential part of marketing or branding. ADR is a familiar mechanism to resolve the business issues in a faster way and less expensive with help of a neutral third party.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand and learn the basic concept of IPR and Patent filing procedure.
2. To understand and familiarize various procedure for grants of patent, trademark and trade secrets.
3. To apply various legal aspects in patent ownership and transfer.
4. To apply and practice the laws relating to the Intellectual property rights.
5. To Create model contexts to practice the ADR mechanism.

COURSE OUTCOMES:

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

CO1: Understand the different aspects of intellectual property rights.	Understand
CO2: Explain the procedure and requirement of to apply New IPR development and related system in India and across the Globe.	Apply
CO3: Analyse the various issues of transfer of patent ownership with reference to International Patent Law.	Analyse
CO4: Evaluate the present system of Patent Act in India and changes aligned with international standards.	Evaluate
CO5: Prepare and assess the mechanism to apply in the business issues in the context of ADR	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS:

UNIT – I: Introduction To IPRs **9**

Basic concepts of Intellectual Property- Patents Copyrights, Geographic Indicators, History of IPRs- the way from WTO to WIPO- TRIPS, Nature of Intellectual Property, Industrial Property, Technological Research, Inventions and Innovations - Defining Intellectual Property and Patents, Patent Searches and Application.

UNIT – II: New Developments in IPR **9**

Procedure for grant of Patents, TM, GIs, Trade Secrets, Patenting under PCT, Administration of Patent system in India, Patenting in foreign countries - International Treaties and conventions on IPRs, The TRIPs Agreement.

UNIT – III: Patent Ownership and Transfer **9**

Defining Intellectual Property and Patents, Patent Searches and Application, Patent Ownership and Transfer, Patent Infringement, New Developments and International Patent Law

UNIT – IV: Legislation of IPRs **9**

The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act and, IPR strength in India - Patent Ownership and Transfer, Patent Infringement, New Developments and International Patent Law

UNIT – V: Alternate Dispute Resolution **9**

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 BOOK:

1. Deborah E. Bouchoux, Intellectual Property Rights, Delmar, Cengage Learning, 2005.

REFERENCES:

1. V. Sople Vinod, Managing Intellectual Property by (Prentice hall of India Pvt.Ltd), 2006.
2. A. Primer, R. Anita Rao and Bhanoji Rao, Intellectual Property Rights, Lastain Book company. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2006.
3. Tejaswini Apte, A single guide to Intellectual property rights, Biodiversity and Traditional knowledge.
4. WIPO Intellectual Property Hand book.
5. Intellectual Property rights and copyrights, Ess Ess Publications.

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	mail id
1	G. Palaniappan	Associate Professor	Management Studies	palaniappan@vmkvec.edu.in
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	INNOVATION, PRODUCT DEVELOPMENT AND COMMERCIALIZATION	Category	L	T	P	Credit
		HSS	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 - Not Required

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	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

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

COURSE DESIGNERS:

S.No	Name of the faculty	Designation	Department	E-Mail Id
1			Management Studies	
2			Management Studies	

	SOCIAL ENTREPRENEURSHIP	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE

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

PREREQUISITE - Not Required

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
1			Management Studies	
2			Management Studies	

	NEW VENTURE PLANNING AND MANAGEMENT	Category	L	T	P	Credit
		HSS	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			Management Studies	
2			Management Studies	

	FINANCE AND ACCOUNTING FOR ENGINEERS	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE: Engineers are in a position to do Decision Making during every activity in the industry. The activities ranging from Operation to Non-Operation during the routine functions of the organization. Especially, Finance and Accounting also becomes the part of responsibility of every engineer to do data analysis activities. His interpretation through data analysis and reporting in every transaction helps the organization to do decision making to run the organization effectively and efficiently. Finance and Accounting Practices enable the engineers to handle the resources to do cost and Financial decisions with optimum resources for the betterment of the organization.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the concepts and conventions to prepare Income Statement, and Balance Sheet.
2. To apply the various methods to claim depreciation and
3. To practice fundamental investment decision through capital budgeting techniques.
4. To analyse cost-volume profit analysis for decision making and analyse standard costing techniques.
5. To estimate the working capital requirements for day-to-day activities and handling inventories with economic ordering quantities.

COURSE OUTCOMES:

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

CO1: Understand the importance of recording, book keeping and reporting of the business transaction.	Understand
CO2: Identify and Apply suitable method for charging depreciation on fixed assets.	Apply
CO3: Analyse the various methods of capital budgeting techniques for investment decision.	Apply
CO4: Justify the scope of cost-volume-profit analysis, standard costing, and marginal costing techniques for decision making.	Analyse
CO5: Estimation of working capital requirements 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
CO1	-	-	M	L	S	M	-	S	-	M	M	L	M	L	M
CO2	L	-	-	L	M	-	L	L	-	-	L	M	L	L	-
CO3	-	M	-	M	L	-	-	L	S	M	-	L	-	L	M
CO4	L	L	-	S	-	-	L	-	-	L	M	L	M	L	M
CO5	L	-	L	S	L	-	-	M	M	L	-	L	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS:

Introduction: Business Environment – Book Keeping and Accounting – Accounting Concepts and Conventions – Double entry system – Preparation of journal, ledger and Trial balance – Final Accounts.

Deprecation: Meaning – Causes - Methods of Calculating Depreciation: Straight Line Method, Diminishing Balance Method and Annuity Method.

Capital Budgeting Decisions: Meaning – Nature & Importance of Investment Decisions – Types - Financial statement analysis and interpretation - Types of Analysis - Objectives - Tools of Analysis - Ratio Analysis: Objectives, Uses and Limitations - Classification of Ratios: Liquidity, Profitability, Financial and Turnover Ratios - Funds Flow Analysis and Cash Flow Analysis: Sources and Uses of Funds, Preparation of Funds Flow statement, Uses and Limitations: Pay Back Period – Accounting Rate of Return – NPV – IRR - Profitability Index.

Marginal Costing: Marginal Cost - Breakeven Analysis - Cost Volume Profit Relationship - Applications of Standard and marginal Costing Techniques.

Working Capital Management: – Types of Working Capital – Operating Cycle – Determinants of Working Capital - Receivables Management – Inventory Management – Need for holding inventories – Objectives – Inventory Management Techniques: EOQ & Reorder point – ABC Analysis - Cash Management – Motives for holding cash.

Text Book

1. Kesavan, C. Elenchezhian, and T. Sunder Selwyan, "Engineering Economics and Financial Accounting", Firewall Media, 2005.
2. Kasi Reddy .M and Saraswathi .S, "Managerial Economics and Financial Accounting", PHI Learning Pvt., Ltd. 2007.

Reference Book

1. Periyasamy .P, "A Textbook of Financial, Cost and Management Accounting", Himalaya Publishing House, 2010.
2. Palanivelu V.R., "Accounting for Managers", Lakshmi Publications, 2005.
1. Mark S Bettner, Susan Haka, Jan Williams, Joseph V Carcello, "Financial and Management Accounting", Mc-Graw-Hill Education, 2017

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	M.Manickam	Associate Professor	Management Studies	manickam@vmkec.edu.in
2	Dr. Rajeshkumar	Assistant Professor	Management Studies	Rajesh.mba@avit.ac.in

EMERGING AREA – OPEN ELECTIVE COURSES

	BIOSENSORS AND TRANSDUCERS	Category	L	T	P	Credit
		OE	3	0	0	3

PREAMBLE

The course is designed to make the student acquire conceptual knowledge of the transducers and biological components used for the detection of an analyte. The relation between sensor concepts and biological concepts is highlighted. The principles of biosensors that are currently deployed in the clinical side are introduced.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To use the basic concepts of transducers, electrodes and its classification.
2	To discuss the various types of electrodes.
3	To determine the recording of biological components.
4	To employ the knowledge in electrochemical and optical biosensors.
5	To outline the various biological components using biosensors.

COURSE OUTCOMES

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

CO1. Describe the working principles of transducers.	Understand
CO2. Explain the various types of electrodes.	Understand
CO3. Utilize various FET sensors for recording of biological components.	Apply
CO4. Distinguish various biosensors like electrochemical and optical biosensors.	Analyze
CO5. Analyze the biological components using biosensors in various applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

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

BIOSENSORS:
Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

APPLICATIONS OF BIOSENSORS:
Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

1. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw HILL, 1995.
2. Brain R Eggins, **"Biosensors: An Introduction",** John Wiley Publication, 1997.
3. Shakthi chatterjee, **"Biomedical Instrumentation"**, Cengage Learning, 2013.
4. John G Webster, **"Medical Instrumentation: Application and design"**, John Wiley Publications, 2001.

REFERENCES:

1. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & sons, 1991.
2. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).
3. Geddes and Baker, **"Principles of Applied Biomedical Instrumentation"**, 3rd Edition, John Wiley Publications, 2008.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.L.K.Hema	Professor & Head	BME	hemalk@avit.ac.in
2	Dr.N.Babu	Professor	BME	babu@vmkvec.edu.in
3	Mr.V.Prabhakaran	Assistant Professor (Gr-II)	BME	Prabhakaran.bme@avit.ac.in
4	Mrs.S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in

	PRINCIPLES OF MEDICAL INSTRUMENTATION	Category	L	T	P	Credit
		OE	3	0	0	3

PREAMBLE

To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To know about bioelectric signals, electrodes and its types.
2	To know the various Biopotential recording methods.
3	To study about patient monitoring concept and various Physiological measurements methods.
4	To study the principle of operation blood flow meter, blood cells counter.
5	To study about bio chemical measurements and details the concept of biotelemetry and patient safety.

COURSE OUTCOMES

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

CO1. Explain the different Bio signal or biopotential.	Understand
CO2. Discuss the working principles of diagnostic and therapeutic equipments.	Understand
CO3. Examine the various instruments like as ECG, EMG, EEG, X-ray machine.	Apply
CO4. Illustrate medical instruments based on principles and application used in hospital.	Analyze
CO5. Analyze and calibrate fundamental biomedical instrumentation used in hospital.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

BIOELECTRIC SIGNALS AND ELECTRODES

Basic medical instrumentation system, Origin of Bioelectric Potential, Recording electrodes – Electrode Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artifacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical conductivity of electrode jellies and creams, Microelectrodes.

BIO AMPLIFIER AND BIOMEDICAL RECORDERS

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

PATIENT MONITORING SYSTEM AND NON ELECTRICAL PARAMETERS MEASUREMENTS

System concepts of patient monitoring system, Bedside patient monitoring system, central monitors, Blood pressure measurement, Measurement of temperature, Respiration rate measurement, cardiac output measurement, Measurement of pulse rate, Plethysmography technique.

BLOOD FLOW METERS, BLOOD CELL COUNTERS

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

BIO- CHEMICAL MEASUREMENTS AND BIOTELEMETRY AND PATIENT SAFETY

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

TEXT BOOKS:

1. Khandpur R.S, **"Hand-book of Biomedical Instrumentation"**, Tata McGraw Hill, 2nd Edition, 2003.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **"Biomedical Instrumentation and Measurements"**, Prentice-Hall India, 2nd Edition, 1997.

REFERENCES:

1. John G. Webster, **"Medical Instrumentation application and design"**, John Wiley, 3rd Edition, 1997.
2. Carr, Joseph J, Brown, John.M, **"Introduction to Biomedical equipment technology"**, John Wiley and sons, New York, 4th Edition, 1997.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. N.Babu	Professor	BME	babu@vmkvec.edu.in
2	Mr.V.Prabhakaran	Assistant Professor (Gr-II)	BME	prabhakaran.bme@avit.ac.in
3	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
4	Ms. Lakshmi Shree	Assistant Professor	BME	lakshmishree.bme@avit.ac.in

	BIOFUEL	Category	L	T	P	Credit
		CC	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	Students will recognize the types and differences between existing energy resources, understand their procurement and utilization, and their impacts on society and the environment
2	Students will be knowledgeable of the existing and potential future sources of renewable energy, and be able to intelligently analyze reported aspects of the energy and renewable energy fields.

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
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in

	FOOD AND NUTRITION TECHNOLOGY	Category	L	T	P	Credit
		CC	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.

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
2	Mrs.C.Nirmala	Associate professor	Biotechnology	nirmala@vmkvec.edu.in

	GREEN BUILDING AND SUSTAINABLE ENVIRONMENT	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Before starting with this course, one must get a clear knowledge on the basics of green building, learning the plan details of HVAC for a building, energy efficient modelling.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define, develop and & Plan the details of Implementation.
2	To summarize the fundamentals of electric power systems and building electric wiring.
3	To demonstrate about the Bioclimatic design and concepts.
4	To construct the water conservation & water management systems.
5	To assess the key components of remodelling project.

COURSE OUTCOMES

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

CO1. Define the basics of green building	Remember
CO2. Discuss the advantages and benefitsof green building practices	Understand
CO3. Illustrate low energy architecture features in residential and commercial buildings	Apply
CO4. Develop proper water conservation systems to make up a healthy building	Apply
CO5. Validate the green sustainable materials and practices	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-		L	-	-	-	-	-	-	L	L	-	-
CO4	M	M	-	-	S	-	L	-	-	-	-	-	-	M	-
CO5	M	M	L	L	S	S	-	L	-	-	-	-	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

GREEN BUILDING BASICS AND PRACTICES:

Site Design / Development & Plan Implementation, Resource Efficiency, Energy Efficiency, Water Efficiency, Indoor Environmental Quality and Homeowner Education, Operation, Maintenance & Practices. Assessment of building design and construction, emission of CO2, SO2, and NO2 of building materials, elements, and construction process.

ENERGY MANAGEMENT SYSTEM OF BUILDINGS

The objective of the course is to provide students the necessary tools to control, monitor and optimize the building's facilities, mechanical and electrical equipment for comfort, safety, and efficiency. It starts with the fundamentals of electric power systems and building electric wiring and then works through building automation systems (BAS) principles. The course allows students to acquaint applying BAS to commercial HVAC equipment, lighting systems, fire systems and security/observation systems.

LOW ENERGY ARCHITECTURE, PASSIVE BUILDING DESIGN

Solar geometry, climate/regional limitations, natural lighting, passive design and sustainability initiatives, insulating and energy storing material. Bioclimatic design and concepts. Case studies will be used extensively as a vehicle to discuss the success/failure of ideas and their physical applications.

WATER MANAGEMENT, BUILDING METHODS & MATERIALS

Water conservation, water management systems, water efficient landscaping, green roofing, rainwater harvesting, sanitary fixtures and plumbing systems, wastewater treatment and reuse, and process water strategies. AAC (Aerated Autoclave Concrete), ICF (Insulated Concrete Forms), new Advanced Framing & Insulation Techniques, SIPs (Structural Insulated Panels), Straw Bale and Pumice-crete Rammed Earth, Timber Frame, Straw Clay, and Earth ship buildings.

ENERGY EFFICIENT REMODELLING

Key components of remodelling projects-windows, walls, roofs, heating and ventilation, insulation, tighten up the building envelope, Advances in building technology and materials, incorporate active and passive solar into the home or commercial building, Mistakes to avoid, various improvements cost

TEXT BOOKS:

1. Kibert, C. J. "Sustainable Construction: Green Building Design and Delivery," Second Edition, New York:
    1. John Wiley & Sons, Inc., 2008.
    2. Thermal analysis and design of passive solar buildings by A. K. Athienitis and Mat Santamouris.
    3. Passive building desing by N.K. Bansal, G. Hauser, and G. Minke.

REFERENCES:

1. McDonough, W. and Braungart, M. "Cradle to Cradle: Remaking the Way We Make Things," New York: Farrar, Straus and Giroux, 2002

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.P.Sangeetha	Professor	Civil	sangeetha@avit.ac.in
2	Ms.R.Subashini	Assistant Professor	Biotechnology	subashini@vmkvec.edu.in

	BIOLOGY FOR NON BIOLOGISTS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list out the students with the basic organization of organisms and subsequent building to a living being
2	To summarize about the machinery of the cell functions that is ultimately responsible for various daily activities.
3	To implement the knowledge about biological problems that requires engineering expertise to solve them.

COURSE OUTCOMES

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

CO1: Recall the structure and cell theory of living organism.	Remember
CO2: Discuss about the biological diversity of life.	Understand
CO3: Classify the application of enzymes in industrial level.	Apply
CO4: Detect the uses of Bioremediation and Biosensors using molecular machines.	Analyse
CO5: Appraise in detail about the principles of cell signalling in nervous system and immune system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOLOGY – CELL AND CELL STRUCTURE AND FUNCTION

Introduction, Scope, Disciplines of biology –An over View of plants, animal, Microorganism.

INTRODUTION TO BIOLOGY – BIO CHEMISTRY, ENZYME, INDUSTRIAL USE

Prokaryotes – Eukaryotes, Cell, Cell structure, Organelles and their functions, Yeast, Bacteria –Friends and Foe.

FOOD DIET NUTRITION

Major constituents of food – carbohydrate, protein, lipids, vitamins and minerals. Balanced diet-BI-Junk food, Fermented food, nutritional values.

ENVIRONMENT

Clean environment-Reduce, Recycle and Reuse-Renewable energy-Waste management –water-waste water management – personal hygiene, Global Climatic Changes -Tsunami, global warming, storms, vardha, Okhi. Recycled products -Paper, No to plastic, go green.

HEALTH, IMMUNE SYSTEM AND MEDICINE

Immunology- Blood Grouping – Antigen- Antibody. Antibiotics, Vaccines their significance. Diagnosis –Parameters in Urine and Blood. Instruments – ECG, ECHO, MRI, X-ray. Prophylaxis, Chemotherapy and Allergy.

TEXT BOOKS:

1. J.M.Berg, J.L.Tymosczko and L.Sryer. Biochemistry, W.H Freeman publication.
2. Student Companion to accompany Biochemistry, Fifth Edition-Richard I. Gum port.
3. Frank H.Deis, Nancy Count Gerber, Roger E.Koeppe, 2 Molecular motors

REFERENCE BOOKS:

1. Albert's, 2003, Molecular Biology of the cell
2. Lodish, 2004, Molecular cell Biology

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.A.Nirmala	Assistant Professor GII	Biotechnology	nirmalabt@avit.ac,in
2	Dr M.Sridevi	Professor & Head	Biotechnology	sridevi@vkvec.edu.in

	DISASTERMANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

Thiscoursedealswiththevariousdisastersandtoexposethestudentsaboutthemeasures,itseffectagainstbuiltstructures ,andHazardAssessmentprocedureinIndia.Thiscoursealsodealswiththemethodsofmitigatingvarioushazardssuchthatth eirimpact on communitiesisreduced.

Prerequisite

NIL

CourseOutcomes

1	ToUnderstandbasicconceptsinDisasterManagement
2	ToUnderstandDefinitionsandTerminologiesusedinDisasterManagement
3	ToUnderstandtheChallengesposedbyDisasters
4	TounderstandImpactsofDisasters

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,studentswillbeableto

CO1.Understandthevarioustypesofdisastervizhydrological,CoastalandMarine Disasters,AtmosphericDisasters,Geological,MassMovementandLandDisasters,Windand WaterDrivenDisasters.	Understand
CO2.Identifythepotentialdeficienciesofexistingbuildingsforearthquakedisasterand suggestsuitableremedialmeasures.	Understand
CO3.Derivetheguidelinesfortheprecautionarymeasuresandrehabilitationmeasuresforearthquak e disaster.	Apply
CO4.Derivetheprotectionmeasuresagainstfloods,cyclone,landslides	Apply
CO5.Understandtheeffectsofdisastersonbuiltstructuresinindia	Understand

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTION: Conceptofdisaster;Differentapproaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etcDos and Don'ts during various types of Disasters.

RISKASSESSMENTANDVULNERABILITYANALYSIS: Responsetime,frequencyandforewarninglevelsofdifferenthazards;Characteristicsanddamage potential of naturalhazards;hazard assessment;Dimensionsofvulnerabilityfactors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards**DISASTER MANAGEMENT MECHANISM:** Concepts of risk management and crisis management ; Disastermanagementcycle;ResponseandRecovery;Development,Prevention,MitigationandPreparedness;Planningfor

relief, Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster

DISASTER RESPONSE: Mass media and disaster management; Disaster Response Plan; Communication, Participation,and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and StressManagement;RumourandPanicManagement;MinimumStandardsofRelief;ManagingRelief;Funding.

DISASTER MANAGEMENT IN INDIA: Strategies for disaster management planning; Steps for formulating a disasterriskreductionplan;DisastermanagementActandPolicyinIndia;Organisationalstructurefordisastermanagementin India; Preparation of state and district disaster management plans, , Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake- holders

TEXTBOOKS:

1.Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423 2.

2.Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10:1259007367, ISBN-13: 978-1259007361]

3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. AbarquezI.&MurshedZ.CommunityBasedDisasterRiskManagement:FieldPractitioner'sHandbook,ADPC,Bangkok,2004.
2. Goudie,A.GeomorphologicalTechniques,UnwinHyman,London1990.
3. Goswami,S.C.RemoteSensingApplicationinNorthEastIndia,PurbanchalPrakesh,Guwahati,1997.
4. ManualonNaturalDisasterManagementinIndia,NCDM,NewDelhi,2001.
5. DisasterManagementinIndia,MinistryofHomeAffairs,GovernmentofIndia,NewDelhi,2011.
6. NationalPolicyonDisasterManagement,NDMA,NewDelhi,2009.
7. DisasterManagementAct.(2005),MinistryofHomeAffairs,GovernmentofIndia,NewDelhi,2005.

CourseDesigners

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Ms.S.IsparaXavier	AssistantProfessor	Civil/AVIT	isparaxavier.civil@avit.ac.in

	MUNICIPALSOLIDANDWASTEMANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

Structureisanarrangementandorganizationofinterrelatedelementsinamaterialobjectorsystem,ortheobjectorsystemsoorganized.Materialstructuresincludeman-madeobjectssuchasbuildingsandmachinesandnaturalobjectssuchasbiologicalorganisms,minerals andchemicals.

Prerequisite

Nil

CourseObjectives

1.	Theon-site/off-siteprocessingofthesameandthedisposalmethods.
2.	Thestudentisexpectedtoknowaboutthevarioueffectsanddisposaloptionsforthemunicipalsolidwaste.
3.	Thecollectionandsupplyofwater
4.	Theoffsiteprocessinginvolvedinsite

CourseOutcomes

Onthesuccessfulcompletionofthecourse,studentswillbeableto

Co1.Toknowaboutthetypesofwaste&Sources	Analyze
Co2.ToStudytheonsiteStorage&Processing	Apply
Co3.Tostudyaboutthecollection&transferthewaste	Apply
Co4.ToStudytheprocessofoffsiteprocessing	Apply
CO5.Toknowaboutthesolidwastedisposal	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus

SOURCESANDTYPESOFMUNICIPALSOLIDWASTES

Sourcesandtypesofsolid 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 &economicaspects;Publicawareness;RoleofNGOs;Legislation.

ON-SITESTORAGE&PROCESSING

On-sitestoragemethods–materialsusedforcontainers–on-sitesegregationofsolidwastes– publichealth&economicaspectsofstorage–optionsunderIndianconditions–Critical EvaluationofOptions.

COLLECTIONANDTRANSFER

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-SITEPROCESSING

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

DISPOSAL

Dumpingofsolidwaste;sanitarylandfills–siteselection,designandoperationofsanitarylandfills– Leachatecollection&treatment.

TextBooks

1. GeorgeTchobanoglouset.al.,"IntegratedSolidWasteManagement",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).

ReferenceBooks

1. R.E.LandrethandP.A.Rebers,"MunicipalSolidWastes–problemsandSolutions",LewisPublishers, 1997.
2. BhideA.D.andSundaresan,B.B.,"SolidWasteManagementinDevelopingCountries",INSDOC,1993.
3. Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous, McGraw Hill Publication, (2002).
4. Bagchi, A., Design, Construction, and Monitoring of Landfills, (2nd Ed). Wiley Interscience, ISBN: 0- 471- 30681- 9.
5. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development,
6. Government of India, New Delhi, (2000).

S.No.	NameoftheFaculty	Designation	Department	MailID
1	Mrs.P.Subathra	AssistantProfessor	Civil/AVIT	subathra@avit.ac.in

	ROBOTICS AND AUTOMATION	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

Robotics is the applied science of motion control for multi-axis manipulators and is a large subset of the field of "Mechatronics" (Mechanical, Electronic and Software engineering for product or systems development, particularly for motion control applications). Robotics, sensors, actuators and controller technologies are continuously improving and evolving synergistically. In the 20th century, engineers have mastered almost all forms of motion control and have proven that robots and machines can perform almost any job that is considered too heavy, too tiring, too boring or too dangerous and harmful for human beings. This course supports the students to design and develop multi-DOF manipulator and wheeled mobile robot.

PREREQUISITE -

COURSE OBJECTIVES

1	To Understand the actuators used in robotic manipulators and indicate their advantages and limitations.
2	To apply the forward kinematic model of multi-degree of freedom to develop a robot arm and wheeled robot
3	To apply a static force and dynamic model of two degrees of freedom to develop robot arm
4	To apply a step-by-step procedure for the generation a cubic polynomial trajectory for a joint with specified kinematic constraints
5	To apply and develop a program for point-to-point applications

COURSE OUTCOMES

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

CO1. Describe the working of the subsystems of robotic manipulator and wheeled mobile robot	Understand
CO2. Develop the forward kinematic model of multi-degree of freedom (DOF) manipulator and inverse kinematic model of two and three degrees of freedom planar robot arm and wheeled robot	Apply
CO3. Develop the static force and dynamic model of two degrees of freedom planar robot arm	Apply
CO4. Generate a trajectory in joint space using polynomial and trigonometric functions with given kinematic constraints of multi-degree of freedom (DOF) manipulator	Apply
CO5. Develop a offline robot program for point-to-point applications such as pick and place, palletizing, sorting and inspection of work-parts	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	L	-	S	M	
CO2	S	L	M	-	-	-	-	-	-	-	M	-	S	M	
CO3	S	L	M	-	-	-	-	-	-	-	M	-	S	M	
CO4	S	L	M	-	-	-	-	-	-	-	M	-	S	M	

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

S- Strong; M-Medium; L-Low

SYLLABUS

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

Kinematic model - Forward Kinematics for two DOF manipulator – Algebraic method, Mechanical structure and notations, Coordinate frames, Description of objects in space, Transformation of vectors, Fundamental rotation matrices (principal axes and fixed angle rotation) Description of links and joints, Denavit- Hartenberg (DH) notation, Forward Kinematics for multi-Degrees of Freedom (DOF) manipulator. Inverse kinematics of 2R, 3R manipulator - Manipulator workspace. Mobile Robot kinematics: kinematic model and constraints, Mobile robot workspace-motion control.

Static model: Differential relationship - Velocity analysis – Jacobian matrix – Determination of forces and equivalent torques for joints of two link planar robot arm. Dynamic model: Euler –Lagrangian formulation - Forward and inverse dynamic model for two DOF planar manipulator. Applications of Fuzzy Logic and Neural network in Robot Control, Neural controllers, Implementation of Fuzzy controllers

Trajectory planning: Definitions and planning tasks, Joint space techniques – Motion profiles – Cubic polynomial, Linear Segmented Parabolic Blends and cycloidal motion - Cartesian space techniques. Navigation: Graph search and potential field path planning - navigation architecture - offline and online planning.

AI And Other Research Trends In Robotics- Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids.

TEXTBOOKS

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

REFERENCE BOOKS

1. B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo, “Robotics: Modelling, Planning and Control”, First Edition, Springer-Verlag London,2009
2. K.S. Fu, R.C Gonzalez and C.S. Lee, “Robotics- Control, Sensing, Vision and Intelligence”, Tata McGraw-Hill Editions, 2008.
3. John J.Craig, “Introduction to Robotics, Mechanics and Control”, Third Edition, Pearson Education, 2005.
4. Mark W.Spong, M.Vidyasagar, “Robot Dynamics and Control”, Wiley India, 2009.
5. George A. Bekey, “Autonomous Robots – From Biological Inspiration to Implementation and Control”, MIT Press, 2005.
6. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George A. Kantor, Wolfram Burgard, Lydia E. Kavraki and

Sebastian Thrun, “Principles of Robot Motion – Theory, Algorithms and Implementation”, MIT Press, 2005.
7. Mikell P. Groover, Mitchell Weiss, Roger N.Nagel and Nicholas G. Odrey, “Industrial Robotics – Technology, Programming and Applications” Tata McGraw-Hill, 2008.
8. Yoram Koren, “Robotics for Engineers”, McGraw-Hill Book Co., 1992.
9. P.A. Janakiraman, “Robotics and Image Processing”, Tata McGraw-Hill, 1995.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
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	ARTIFICIAL INTELLIGENCE	Category	L	T	P	Credit
		OE	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

	FUNDAMENTALS OF INTERNET OF THINGS	Category	L	T	P	Credit
		OE	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

S

S

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
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	INTRODUCTION TO INDUSTRY 4.0 ANDINDUSTRIAL 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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	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, 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	Prof.&Head/ECE	ECE	hodece@avit.ac.in
2	Dr.T.Muthumanickam	Professor	ECE	hodece@vmkvec.edu.in

	GREEN POWER GENERATION SYSTEMS	Category	L	T	P	Credit
		EC(OE)	3	0	0	3

PREAMBLE

The course presents the various sources of renewable energy including wind, solar, and biomass as potential sources of energy and investigates the contribution they can make to the energy profile of the nation. The technology used to harness these resources will be presented. Discussions of economic, environment, politics and social policy are integral components of the course.

PREREQUISITE: NIL

COURSE OBJECTIVES

1	Understand the nexus between energy, environment, and sustainable development
2	Appreciate energy ecosystems and its impact on environment
3	Learn basics of various types of renewable and clean energy technologies
4	Serve as bridge to advanced courses in renewable energy

COURSE OUTCOMES

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

CO1: Explain renewable energy sources & systems.	Understand
CO2: Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen, and sterling engine.	Apply
CO3: Analyze and evaluate the implication of renewable energy. Concepts in solving numerical problems pertaining to solar radiation geometry and wind energy systems.	Analyze
CO4: Demonstrate self -learning capability to design & establish renewable energy systems.	Analyze
CO5: Conduct experiments to assess the performance of solar PV, solar thermal and biodiesel systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

ENERGY

Introduction to the nexus between energy, environment and sustainable development, Energy sources overview and classification, sun as the source of energy, fossil fuel reserves and resources - overview of global/ India's energy scenario. Energy consumption models – Specific Energy Consumption

ECOLOGY AND ENVIRONMENT

Concept and theories of ecosystems, - energy flow in major man-made ecosystems- agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere - air, water, soil, and environment - environmental laws on pollution control, The environmental protection act: Effluent standards and ambient air quality, innovation and sustainability, eco-restoration: Phyto-remediation.

RENEWABLE SOURCES OF ENERGY

Solar Energy: Solar radiation: measurements and prediction. Indian's solar energy potential and challenges, solar energy conversion principles and technologies: Photosynthesis, Photovoltaic conversion, and Photo thermal energy conversion. Wind Energy: Atmospheric circulations, atmospheric boundary layers, classification, factors influencing wind, wind shear, turbulence, wind energy basics and power Content, wind speed monitoring, Betz limit, wind energy conversion system: classification, characteristics, and applications. Ocean Energy: Ocean energy resources-ocean energy conversion principles and technologies: ocean thermal, ocean wave & ocean tide

BIOENERGY

Biomass as energy resources; bio-energy potential and challenges, Classification, and estimation of biomass; Source and characteristics of biofuels: Biodiesel, Bioethanol, Biogas. Types of biomass energy conversion systems - waste to energy conversion technologies

OTHER ENERGY SOURCES AND SYSTEMS

Hydropower, Nuclear fission, and fusion-Geothermal energy: Origin, types of geothermal energy sites, site selection, geothermal power plants; hydrogen energy, Magneto-hydro-dynamic (MHD) energy conversion – Radioisotope Thermoelectric Generator (RTG), Bio-solar cells, battery & super capacitor, energy transmission and conversions.

TEXTBOOKS:

1. Energy and the Environment, Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., 2nd Edition, John Wiley, 2006,
2. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.

REFERENCE BOOKS:

1. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 2010
2. Introduction to Electrodynamics (3rd Edition), David J. Griffiths, Prentice Hall, 2009

COURSE DESIGNERS

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1	Dr. R. Devarajan	Professor	EEE	devarajan@vmkvec.edu.in
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3	Mr. V.Rattankumar	Assistant Professor	EEE	rattankumar@avit.ac.in

	INDUSTRIAL DRIVES AND AUTOMATION	Category	L	T	P	C
		EC(OE)	3	0	0	3

Preamble

To introduce foundation on the principles of drives & automation and their elements with the implementation.

PREREQUISITE : NIL

COURSE OBJECTIVES

1	To explore the various AC,DC & Special Machine Drives for industrial Application
2	To study about the various Open loop and closed loop control schemes for drives
3	To know about hardware implementation of the controllers using PLC
4	To study the concepts of Distributed Control System
5	To understand the implementation of SCADA and DCS

COURSE OUTCOMES

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

CO 1	To understand working principles of various types of motors, differences, characteristics and selection criteria.	Understand
CO 2	To apply the knowledge in selection of motors, heating effects and braking concepts in various industrial applications	Apply
CO 3	To explain control methods of special drives	Understand
CO 4	To carry out programming using PLC and use of various PLCs to Automation problems in industries.	Understand
CO 5	To discuss supervisory control and data acquisition method and use the same in complex automation areas	Understand
CO6	To understand and use logical elements and use of Human Machine Interfacing devices to enhance control & communication aspects of Automation	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	-	-	-	M	-

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

SYLLABUS

INTRODUCTION

Working principle of synchronous, Asynchronous & stepper motors, Difference between Induction and servo motors, Torque v/s speed characteristics, Power v/s. Speed characteristics, Vector duty induction motors, Concepts of linear and frameless motors, Selection of feedback system, Duty cycle, , V/F control, Flux Vector control.

INDUSTRIAL DRIVES

Electric drive – Definition – Parts – Types -Individual – Group – Multi motor. Stepper motor – Definition – Step angle – Slewing rate -Types -Variable reluctance -Hybrid – Closed loop control of stepper motor – Drive system(any one) – logic sequencer – Optical encoder. Servo motor – Definition – Types -DC servo motor – Permanent magnet DC motors – Brushless motor – AC servo motor -Working of an AC servo motor in control system – Induction motors – Eddy current drive for speed control of induction motors.

PROGRAMMABLE LOGIC CONTROLLER

Definition Conventional Hard wired logicRelays- Features of PLC- Advantages of PLC over relay logic – Block diagram of PLC -Programming basics of PLC – Ladder logic -Symbols used in ladder logic – Logic functions – Timers – Counters – PLC networking – Steps involved in the development of Ladder logic program – Program execution and run operation by PLC – Ladder logic diagram for liquid level operation. List of various PLCs and their manufactures.

DISTRIBUTED CONTROL SYSTEM

Evolution of distributed control system -Definition of DCS – Functional elements of DCS – Elements of local control unit -Interfaces-Types of information displays – Architecture of anyone commercial DCS – Advantages of DCS -Selection of DCS – List of various DCS and their manufactures.

SUPERVISORY CONTROL & DATA ACQUISITIONS

Introduction to Supervisory control & data Acquisitions, distributed Control System (DCS): computer networks and communication in DCS. different BUS configurations used for industrial automation – GPIB, HART and OLE protocol, Industrial field bus – FIP (Factory Instrumentation Protocol), PROFIBUS (Process field bus), Bit bus. Interfacing of SCADA with controllers, Basic programming of SCADA, SCADA in PC based Controller / HMI.

TEXTBOOK

1. 1. G.K.Dubey, Fundamentals of Electrical Drives', Narosa Publication,2002.
2. FrankD.petruzellaprogrammable logic controlsthird edition TATA mc graw-hill edition 2010.
3. M.S.Berde, Electric Motor Drives Khanna publishers.2008

REFERENCES

1. Pradheepkumarsrivastava, Programmable logic controllers with applications', BPB publications.2004.
2. John W.Webb, Ronald A.Reis, Programmable logic controllers-Principles and Applications', Fifth Edition, Prentice Hall of India.
3. Michel P.Lukas, Distributed Control system', van Nostrand Reinhold Co, 1986
4. R.SrinivasanSpecial electrical Machines lakshmi publication.2012
5. Process Control Instrumentation Technology, Johnson Curties, Prentice hall of India, 8th edition
6. Andrew Parr, Industrial drives, Butterworth – Heineaman

COURSE DESIGNERS

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