VINAYAKA MISSION'S RESEARCH FOUNDATION

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

Faculty of Engineering and Technology

Programme : M.E – Manufacturing Engineering – PART TIME

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum & Syllabus

(Semester I to IV)

Regulations 2021

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

Department of Mechanical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	The graduates will execute their professional skills and knowledge acquired in the field of manufacturing engineering and management of the resources
PEO 2	The graduates will provide the innovative solutions to the problems arising in production to implement the green manufacturing
PEO 3	The graduate will execute the work with professional ethics, team work, develop quality products and will follow human values in their life.
PEO 4	The graduates will be able to develop innovative products and to become entrepreneur.
PEO 5	The graduates will involve in continuous learning and will be able to execute consultancy services.

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	**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.
PO11	**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

ME – MANUFACTURING ENGINEERING

S.No	Category of Courses	Credits to be earned
1	A. Foundation Courses a. Basic Sciences Courses - 3 credit b. Research Methodology and IPR - 2	**5**
2	B. Program core courses	**32**
3	C. Elective courses a. Program electives - 15 b. Open electives - 03	**18**
4	D. Employability Enhancement Courses and courses for presentation of Technical skills related to the specialization Project work phase I - 6 Project work phase II - 12 Internship/Industrial training - 1 Research paper writing technical Seminar - 1	**20**
5	Mandatory Courses Audit Courses - 2 courses to be selected	**0**
		75

Semester - I								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Applied Probability and Statistics	Maths	BS	3	0	0	3
2		Advanced in Manufacturing Technology	MECH	CC	3	0	0	3
3		Computer Integrated Manufacturing Systems	MECH	CC	3	0	0	3

Semester - II								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Optimization Techniques in Manufacturing	MECH	CC	3	0	0	3
2		Advances in Metrology and Inspection	MECH	CC	3	0	0	3
3		Metal Forming Process	MECH	CC	3	0	0	3
4		Automation and Metal Forming Laboratory	MECH	CC	0	0	4	2
5		Audit course - II			2			0
6		Internship/Industrial training						1

Semester - III								
1		Advances in Casting and Welding	MECH	CC	3	0	0	3
2		Advanced Materials Technology	MECH	CC	3	0	0	3
3		Professional Elective I	MECH	EC	3	0	0	3
4		CIM Laboratory	MECH	CC	0	0	4	2
5		Modelling and Analysis Lab	MECH	CC	0	0	4	2
6		Audit course - I			2			0

Semester - IV								
1		Metal Cutting Theory and Practice	MECH	CC	3	0	0	3
2		Professional Elective II	MECH	EC	3	0	0	3
3		Professional Elective III	MECH	EC	3	0	0	3
4		Advanced Metallurgy Lab	MECH	CC	0	0	4	2
5		Research paper writing technical Seminar	MECH					1

Semester - V								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Professional Elective IV	MECH	EC	3	0	0	3
2		Professional Elective V	MECH	EC	3	0	0	3
3		Open Elective		OE	3	0	0	3
4		Research Methodology and IPR	MECH	FC	3	0	0	2
5		Project Work Phase I	MECH	D			12	6

Semester - VI								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Project Work Phase II	MECH	D	**0**	**0**	24	12

Elective -I								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Fluid Power Automation	MECH	EC	3	0	0	3
2		Design for Manufacture and Assembly	MECH	EC	3	0	0	3
3		Micro Manufacturing	MECH	EC	3	0	0	3
4		Quality and Reliability Engineering	MECH	EC	3	0	0	3

Elective -II								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Finite Element Methods for Manufacturing Engineering	MECH	EC	3	0	0	3
2		Materials Management & Logistics	MECH	EC	3	0	0	3
3		Industrial Ergonomics	MECH	EC	3	0	0	3
4		Robot Design & Programming	MECH	EC	3	0	0	3
5		Non-Destructive Testing and Evaluation	MECH	EC	3	0	0	3
6		Lean Manufacturing	MECH	EC	3	0	0	3
7		MEMS and Nanotechnology	MECH	EC	3	0	0	3

Elective -III								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Computer Aided Product Design	MECH	EC	3	0	0	3
2		Process Planning and Cost Estimation	MECH	EC	3	0	0	3
3		Manufacturing Management	MECH	EC	3	0	0	3
4		Nano-structured Materials and Applications	MECH	EC	3	0	0	3
5		Materials Testing and Characterization Techniques	MECH	EC	3	0	0	3
6		Mechatronics	MECH	EC	3	0	0	3
7		Composite materials	MECH	EC	3	0	0	3
8		Emerging Materials	MECH	EC	3	0	0	3
9		Manufacturing System Simulation	MECH	EC	3	0	0	3
10		Product Lifecycle Management	MECH	EC	3	0	0	3
11		Additive Manufacturing	MECH	EC	3	0	0	3
12		Product Design and Development	MECH	EC	3	0	0	3
13		Entrepreneurship Development	MECH	EC	3	0	0	3

Open Elective								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		Project Management for Engineering Business and Technology	MGT	OE	3	0	0	3
2		Green Power Generation Systems	EEE	OE	3	0	0	3
3		Operations Research	Maths	OE	3	0	0	3
4		New Venture Planning and Management	MGT	OE	3	0	0	3
5		Fundamentals of Internet of Things	CSE	OE	3	0	0	3

Audit Course 1 & 2								
S.No	**Course Code**	**Course Name**	**Offering Dept**	**Category**	**L**	**T**	**P**	**C**
1		English for Research Paper Writing	HSS					
2		Disaster Mitigation and Management	Civil					
3		Constitution of India	Civil					
4		Value Education						
5		Stress Management by Yoga						
6		Personality Development through Life Enlightenment Skills						

FOUNDATION COURSES

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

PREAMBLE

This course is designed to provide the solid foundation on topics in applied probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis and multivariate analysis.

PREREQUISITE - Nil

COURSE OBJECTIVES

1	To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
2	To introduce the concepts of sampling distributions and the test statistics
3	To provide an understanding of the statistical methods and concepts by which real life problems are analyzed.
4	To train the students in design experiments and use these concepts for research
5	To understand the basics of Multivariate Analysis

COURSE OUTCOMES

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

CO1. Able to analyze the performance in terms of probabilities and distributions achieved by the determined solution.	Apply
CO2. Aware of various test statistics for the samples.	Apply
CO3. develop an ability to apply statistical tests in experiments as well as to analyze and interpret data	Apply
CO4. use the concepts in design of experiments in real life problems	Apply
CO5. Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

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

S- Strong; M-Medium; L-Low

SYLLABUS

RANDOM VARIABLES

Random variables — Probability function - Standard Distributions - Binomial, Poisson, Geometric, Uniform, Exponential, Normal distributions and their applications.

ESTIMATION THEORY

Sampling distributions – Estimation of parameters (consistent and unbiased) – Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments - Curve fitting by principle of least squares – Regression lines.

TESTING OF HYPOTHESIS

Hypothesis testing – Small samples/Large Samples – Tests concerning proportion, means, standard deviations – Tests based on chi square – Non parametric test – Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov – Smirnov test , Spearman's and Kendall's test.

DESIGN OF EXPERIMENT: Experimental design – Analysis of variance – Methods for one, two factor models, – 2^k Factorial Design - Confounding in Factorial Design – Fractional Factorial Design - Response Surface Methods – Central Composite Design

MULTIVARIATE ANALYSIS Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables

TEXT BOOKS:

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

REFERENCES:

1. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi (2015).
2. I.R. Miller, J.E. Freund and R. Johnson, " Probability and Statistics for Engineers", 8th Edition, (2015)

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr. P.Sasikala	Professor	Mathematics	sasikala@vmkvec.edu.in

2.	Dr. M.Thamizhsudar	Asso. Professor	Mathematics	thamizhsudar@avit.ac.in

Course Code	Course Title	category	L	T	P	C
	Research Methodology and IPR	**HSS**	**2**	**0**	**0**	**2**

Course Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information.
3. Follow research ethics.
4. Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis, the need of information about Intellectual Property Right to be promoted among students in general & Engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I- RESEARCH PROBLEM AND SCOPE FOR SOLUTION

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II- FORMAT

Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III- PROCESS AND DEVELOPMENT

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, patenting under PCT.

UNIT IV- PATENT RIGHTS

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V- NEW DEVELOPMENTS IN IPR

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"Juta Publishers,1996.

2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" , Juta Publishers,2004.

3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

REFERENCES

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

2. Mayall, "Industrial Design", McGraw Hill, 1992.

3. Niebel, "Product Design", McGraw Hill, 1974.

4. Asimov, "Introduction to Design", Prentice Hall, 1962.

5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

PROGRAM CORE COURSES

	ACVANCED IN MAUFACTURING TECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

. To expose the students in the art of manufacturing new products due to the development of new materials

Prerequisite

NIL

Course Objective

1	To inform the students about the various alternative manufacturing processes available.
2	To develop an attitude to look for the unconventional manufacturing process to machine
3	To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices

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

CO1.	To understand the concepts and methods of various newer machining processes	Understand
CO2.	To gain knowledge in the application of wire cut EDM and relative process	Apply
CO3.	To analyze the laser beam machining process and to study its merits and demerits during application	Analyze
CO4.	To be familiar with the various applications of surface modification and bulk machining	Apply
CO5.	To develop knowledge in the application of micro fabrication technology	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	-	-	M	-	-	-	-	-	-	M	-	
CO2	S	S	M	M	-	M	-	-	-	-	-	-	M	-	
CO3	S	M	M	M	-	M	-	-	-	-	-	-	M	-	
CO4	S	S	M	M	-	M	-	-	-	-	-	-	M	-	
CO5	S	S	S	S	-	S	-	-	-	-	-	-	S	-	

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I NEWER MACHINING PROCESSES - I **9**

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II **9**

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III **9**

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

UNIT IV FABRICATION OF MICRO DEVICES **9**

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication

UNIT V MICROFABRICATION TECHNOLOGY **9**

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.– steriolithography SAW devices, Surface Mount Technology,

REFERENCES: **TOTAL:45 PERIODS**

1.	Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2.	Micro senors Mems & smart devices- Julian W.Hardner – 2002
3.	Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4.	Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5.	Nario Taniguchi – Nano technology – Oxford University Press 1996.
6.	Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co., 1980

Course Designers				
S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	Dr.R.Jayaraman	Assoc. Prof.	MECH/VMKVEC	jayaramanr@vmkvec.edu.in
2				

	ADVANCED MATERIALS TECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

This course to gives thorough knowledge on advanced concepts of material technologies of all Engineering materials.

Prerequisite : NIL

Course Objective

1	To impart knowledge on elastic, plastic and fractured behaviour of engineering materials.
2	To understand the behavior of materials under various loads.
3	To understand the selection of metallic and non-metallic materials for the various engineering applications.

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

CO1.	Understand the concepts of elastic, plastic behavior and strengthening mechanism. Also properties and applications of metallic and non metallic materials.	Understand
CO2.	Analyse the behavior of materials under various loading conditions.	Analyse

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	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

ELASTIC AND PLASTIC BEHAVIOR **9**

Elasticity in metals and polymers - Anelastic and visco-elastic behaviour – Mechanism of plastic deformation– Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, , precipitation hardening and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity. – Deformation of non crystalline materials.

FRACTURE BEHAVIOUR **9**

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

SELECTION OF MATERIALS **9**

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

MODERN METALLIC MATERIALS **9**

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

NON METALLIC MATERIALS **9**

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al_2O_3, SiC, Si_3N_4, CBN and diamond – properties, processing and applications.

Reference Books

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd edition), Butterworth-Heiremann, 2001.
4. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
5. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
6. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

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	S. Arunkumar	Assistant Professor	MECH/VMKVEC	arunkumar@vmkvec.edu.in

	ADVANCED METALLURGY LABORATORY	Category	L	T	P	Credit
			0	0	4	2

Preamble

Workshop practices is fundamental to the development of any engineering product. This course is intended to expose engineering students to different types of manufacturing/ fabrication processes. It deals with machine, fitting, carpentry, foundry, smithy and welding related exercises. Also, it will induce the habit of selecting right tools, planning the job and its execution.

Prerequisite –NIL

Course Objective

1	Exposure to the students with hands on experience on various basic engineering practices in Engineering.
2	To have a study and hands-on-exercise on plumbing and carpentry components.
3	To have a practice on gas welding, foundry operations and fitting

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

CO1.	Upon completion of this laboratory course, students will be able to fabricate components with their own hands.	Apply
CO2.	Examine the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	Apply
CO3.	Assembling different components, they will be able to produce small devices of their interest.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

Syllabus

Work Shop Practice

1. Study and use of metallurgical microscope.
2. Study of muffle furnace.
3. Study of Recovery, Recrystallisation and Grain growth of cold worked materials.
4. Metallographic specimen preparation, mechanical polishing, mounting, and etching.
5. Identification of Microstructure of different types of cast iron & steel specimens (Minimum 6) and use of specific etchants.
6. Identification of Microstructure of non-Ferrous specimens (Minimum 2)
7. and use of specific etchants.
8. Heat treatment – Normalizing – comparation between annealed and unheat treated specimen.

Text Books

1	**WORKSHOP/MANUFACTURING PRACTICES, MANUAL**

Reference Books

1	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I and Vol. II , Media promoters and publishers private limited, Mumbai

2	Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House.			
3	NR. Banapurmath, Basic Mechanical Engineering, Vikas Publications, Noida.			
4	K.Venugopal, Basic Mechanical Engineering, Anuradha Publications, Chennai.			
Course Designers				
S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	T.Raja	Asso.Prof	Mech / VMKVEC	rajat@vmkvec.edu.in
2				

	ADVANCES IN CASTING AND WELDING	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

To make the students learn about need advance in casting and welding technology

Prerequisite : NIL

Course Objective

1	To study the metallurgical concepts and applications of casting and welding process.
2	To impart the knowledge of joining different metallic and non metallic materials.

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

CO1.	Model the solidification process of castings and design of gating and risering	Apply
CO2.	Evaluate the suitability of various casting processes for a product.	Apply
CO3.	Evaluate the weldability of metals and alloys and their metallurgical aspects.	Analyze
CO4.	Select appropriate advanced welding techniques for aerospace, nuclear, automobile and naval applications	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

CASTING DESIGN **8**

Heat transfer between metal and mould –– Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

CASTING METALLURGY **8**

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification –– Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT **8**

Shell moulding, precision investment casting, CO_2 moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry –– Computer aided design of casting.

WELDING METALLURGY AND DESIGN **10**

Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

RECENT TRENDS IN WELDING **11**

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

Reference Books

1. ASM Handbook, Vol 15, Casting, 2004
2. ASM Handbook vol.6, welding Brazing & Soldering, 2003
3. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
4. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002
5. HEINELOPER & ROSENTHAL, Principles of Metal Casting, Tata McGraw Hill, 2000.
6. Jain P.L., Principles of Foundry Technology,Tata McGrawHill Publishers, 2003
7. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
8. IOTROWSKI – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
9. SCHWARIZ, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981
10. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.
11. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980.

Course Designers

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

	ADVANCES IN METROLOGY AND INSPECTION	Category	L	T	P	Credit
		CC	3	0	0	3

Prerequisite: Engineering Materials and Metallurgy

CourseObjective

1	Understand the various concepts of metrology and measurements
2	Develop the knowledge on various measurement methods of surface roughness
3	Understand the principles of light interference
4	Study various measuring tools and laser gauges
5	Understand the image processing for metrology

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Explain the various terminologies and measurement standards, errors and precisions of metrology	Understand
CO2.	Analyzethe materials surfaces and roughness by contact and non-contact methods	Analyze
CO3.	Apply the various measurement technique on 3D surface and nano level surface	Apply
CO4.	Analyse the calibration of instruments and measurement of interferometers	Analyze
CO5.	Analyze the various measuring techniques in various machinery	Analyze
CO6.	Apply the various inspection methods in Laser techniques	Apply
CO7.	Apply various image processing systems and image transformation in Metrology	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	CONCEPTS OF METROLOGY	9
Terminologies – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments – Basics of Dimensional metrology and Form metrology		
Module 2	MEASUREMENT OF SURFACE ROUGHNESS	9
Definitions – Types of Surface Texture: Surface Roughness Measurement MethodsComparison, Contact and Non Contact type roughness measuring devices, 3D Surface Roughness Measurement, Nano Level Surface Roughness Measurement – Instruments.		
Module 3	INTERFEROMETRY	9
Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.		
Module 4	MEASURING MACHINES AND LASER METROLOGY	9
Tool Makers Microscope – Microhite – Coordinate Measuring Machines – Applications – Laser Micrometer, Laser Scanning gauge, Computer Aided Inspection techniques - In-process inspection, Machine Vision system- Applications.		
Module 5	IMAGE PROCESSING FOR METROLOGY	9
Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms - Examples		

TextBooks	
1	"ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
2	Bewoor, A.K. and Kulkarni,V.A.,"Metrology and Measurement", Tata McGraw-Hill, 2009.

ReferenceBooks	
1	Galyer, F.W. and Shotbolt, C.R., "Metrology for engineers", ELBS, 1990.
2	Gupta, I.C., "A Text Book of engineering metrology", DhanpatRai and Sons, 1996
3	Jain ,R.K.,"Engineering Metrology", Khqanna Publishers, 2008.
4	Rajput,R.K., "Engineering Metrology and Instrumentations", Kataria& Sons Publishers, 2001.
5	Smith,G.T., "Industrial Metrology", Springer, 2002

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	R.MAHESH	Assistant Professor	Mech/AVIT	mahesh@avit.ac.in
2				

	AUTOMATION AND METAL FORMING LABORATORY	Category	L	T	P	Credit
		CC	0	0	4	2

Prerequisite:Nil

CourseObjective

1	To familiarize and train the students to have an hands on having the basic concepts of metal forming processes
2	To impart the knowledge of various metal forming processes and manufacturing process
3	To determine some metal forming parameters for a given shapepowder metallurgy.
4	To understand the concept of automation
5	To impart the knowledge of hydraulics and pneumatics circuits with PLC

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	To impart practical knowledge on bulk metal forming and sheet metal forming processes	Apply
CO2.	Illustrate the characteristics of the forming and shaping processes	Apply
CO3.	Apply the concepts of various metal forming process	Apply
CO4.	Develop PLC for modern manufacturing applications using standard procedures	Apply
CO5.	Identify the possibilities of automation and develop a suitable system to automate the processes.	Apply

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus				
1. Determination of strain hardening exponent 2. Construction of formability limit diagram 3. Determination of efficiency in water hammer forming 4. Determination of extrusion load 5. Study on two high rolling process 6. Simulation of Hydraulic circuits 7. Simulation of electro pneumatic circuits 8. Simulation of electro hydraulic circuits 9. Simulation of PLC circuits 10. Software simulation of fluid power circuits using Automation studio.				
TextBooks				
1	AUTOMATION AND METAL FORMING LAB Manual			
CourseDesigners				
S.No	**FacultyName**	**Designation**	**Department/ College**	**Emailid**
1	K.Vijayakumar	AssistantProfessor	Mech/AVIT	vijayakumar@avit.ac.in
2				

	CIM LAB	Category	L	T	P	Credit
		CC	0	0	3	2

Preamble

This course provides the in depth knowledge about CNC machine, CNC programming and modeling software.

Prerequisite – NIL

Course Objective

1	To discuss the basics of manual part programming for turning and milling.
2	To practice the methodologies for writing the CNC program using canned cycles and subroutines.
3	To learn and write the program using mirroring, left / right hand radius compensation concept, rectangular and circular pocketing.
4	To study about various sensors, transducers and PLC
5	To design 2D and 3D modelling of mechanical components

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

CO1.	To study about various sensors, transducers and PLC	Understand
CO2.	To learn the basic knowledge about G and M codes and Apply the programming knowledge to write the program for linear and circular interpolation	Apply
CO3.	Apply the knowledge of mirroring and subroutine concepts to write the CNC program	Apply
CO4.	Apply the knowledge of Left hand and right hand radius compensation, the different types of canned cycles including turning, facing, grooving, drilling, boring and threading etc.,	Apply
CO5.	Design and analyze 2D and 3D modeling of various mechanical components	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	L	L	-	-	-	-	-	-	-	L	L	L	L
CO2	S	S	M	S	-	-	-	-	M	-	-	M	L	L	L
CO3	S	S	S	S	-	-	-	-	M	-	-	M	S	M	M
CO4	S	S	S	S	-	-	-	-	M	-	-	M	S	M	M
CO5	S	S	S	S	-	-	-	-	S		-	S	S	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

LIST OF EXPERIMENTS:

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students have to submit a mini report and present his work before a Committee.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

Text Books				
1	CAM LAB Manual			
Course Designers				
S.No	**Faculty Name**	**Designation**	**Department/ College**	**Email id**
1	Dr.M.SARAVANAN	Asst. Professor	Mech / VMKVEC	saravanan@vmkvec.edu.in

	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

The students completing this course are expected to understand the nature and role of computers in manufacturing. The course includes computer aided design, Automatic Manufacturing Systems, Group Technology and FMS, computer aided process planning techniques, shop floor control, types of process control and automatic data capture systems. It exposes the students to various current trends followed in the industries.

Prerequisite: Nil

Course Objective

1	To understand the importance of CAD and CAM
2	To enable student to learn about Automated Manufacturing Systems
3	To understand about the Group Technology and FMS
4	To gain knowledge about Process Planning
5	To enable students to learn about types of process control and automatic data capture

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

CO1.	Discuss the basic concepts of Computer Aided Design and Manufacturing	Understand
CO2.	Apply the concept of Modeling techniques for designing the roducts	Apply
CO3.	Discuss the basics, working principles of various components of Automated Manufacturing Systems.	Apply
CO4.	Apply the concepts of Group technology and FMS	Apply
CO5.	Apply the concepts of process planning techniques.	Apply
CO6	Analyze the functions of various types of process control and automatic data capture.	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	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	L	-	-	-	-	-	-	-	-	-	L	-	L
CO3	S	M	L	-	-	-	-	-	-	-	-	-	M	-	M
CO4	S	S	M	L	-	-	-	-	-	M	-	-	M	-	M
CO5	S	S	S	M	-	-	-	-	-	M	-	-	L	-	L
CO6	S	S	S	M	S	-	-	-	-	S	-	-	L	-	L

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION **6**

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

AUTOMATED MANUFACTURING SYSTEMS **10**

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features.

Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety.

Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system

Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

GROUP TECHNOLOGY AND FMS **10**

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies.

FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS – FMS applications, Benefits.

PROCESS PLANNING **10**

Process planning – Activities in process planning, Informations required. From design to process planning – classification of manufacturing processes – Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study.

Typical process sheet – case studies in Manual process planning.

Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE **9**

Introduction to process model formulation – linear feedback control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control.

Text Books

1	Mikell.P.Groover "Automation, Production Systems and Computer Integrated manufacturing", Pearson Education 2001.
2	Radhakrishnan P, Subramanyan.S. and Raju V., "CAD/CAM/CIM", 2nd Edition New Age International (P) Ltd., New Delhi, 2000.

Reference Books

1	James A.Retrg, Herry W.Kraebber, "Computer Integrated Manufacturing", Pearson Education, Asia, 2001.
2	Gideon Halevi and Ronald D.Weill, "Principles of Process Planning", Chapman Hall, 1995.
3	Viswanathan,N., and Narahari,Y., "Performance Modeling and Automated Manufacturing Systems", Prentice Hall of India Pvt. Ltd., 2000.

4	Kant Vajpayee,S., "Computer Integrated Manufacturing", Prentice Hall of India, New Delhi, 2007.
	Alavudeen and Venkateshwaran, "Computer Integrated Manufacturing", PHI Learning Pvt. Ltd., New Delhi, 2008.

Course Designers

S.No	**Faculty Name**	**Email id**
1	Dr.M.SARAVANAN	saravanan@vmkvec.edu.in
2		

	METAL CUTTING THEORY AND PRACTICE	Category	L	T	P	Credit
		CC	3	0	0	3

Prerequisite
NIL

Course Objective

1	To study the various design considerations for tooling.
2	To enable students understand their knowledge on Tooling for Metal removal process.
3	To assess various Metal forming Process and its applications
4	To gain knowledge Inspection and Gauging in Engineering applications.
5	Develop knowledge in tooling and work holding devices

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

CO1.	To assess various types of Tooling in Manufacturing and Inspection	Understand
CO2.	To Design Jigs and Fixtures by using given Parameters related to Engineering Applications	Apply
CO3.	To apply the concepts of Metal casting and Metal Joining Process in an engineering problem using standard values	Apply
CO4.	To apply the concepts of Inspection and Gauging by using CMM	Apply
CO5.	Design and Develop tooling for Flexible Manufacturing	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	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	L	L	L	-	-	-	S	S	S	-	-	S	-	-
CO2	S	M	M	L	-	-	-	S	S	S	-	-	S	-	-
CO3	S	M	M	L	-	-	-	S	S	S	-	-	S	-	-
CO4	S	M	M	L	-	-	-	S	S	S	-	-	S	-	-
CO5	S	M	M	M	-	-	-	S	S	S	-	-	S	-	-

S-Strong; M-Medium; L-Low

Syllabus

Module – I	**INTRODUCTION**	**9 hrs**

Manufacturing Processes-objectives of manufacturing processes-classification of manufacturing process- Objectives of Tool design-tool design process- Nature and scope of Tool engineering principles of economy for tooling-problems of economy in tooling-planning and tooling for economy Manufacturing principles applicable to process and tool planning-tool control-tool maintenance-tool materials and its selection

Module – II	**TOOLING FOR METAL REMOVAL PROCESSES**	**12 hrs**

Traditional machining processes -work and tool holding devices-tool nomenclatures Mechanism of machining-force temperature and tool life of single point tool-multipoint tools -tool design-tool wear special processes-capstan and turret lathe-tooling layout of automats-tooling in NC and CNC machines-tooling for machining centres-CAD in tool design- Jigs and fixtures-design-Non-traditional material removal processes mechanical, electrical thermal and chemical energy processes-principles operation equipment-tooling parameters- Advantages, disadvantages and Applications.

Module – III	**TOOLING FOR METAL FORMING PROCESSES**	**9hrs**

Classification of Forming processes- Types of presses-design of -blanking and piercing dies-simple, compound, combination and progressive dies- Drawing dies - Bending dies-forging dies-plastic moulding dies. Applications of dies.

Module – IV	**TOOLING FOR METAL CASTING AND METAL JOINING PROCESSES**	**9 hrs**

Tools and Equipment for moulding-patterns– pattern allowances – pattern construction-die casting tools- mechanization of foundries. Tooling for Physical joining processes Design of welding fixtures – Arc welding, Gas welding, Resistance welding, laser welding fixtures- Tooling for Soldering and Brazing Tooling for Mechanical joining processes

Module – V	**TOOLING FOR INSPECTION AND GAUGING**	**6 hrs**

Survey of linear and angular measurements-standards of measurement-design and manufacturing of gauges- measurement of form- Inspection bench centre-co-ordinate measuring machine-tooling in CMM. Applications of CMM.

TEXT BOOKS

1. Kalpak Jian S., Manufacturing Engineering and Technology
   Addison Wesley.
2. Hoffman E.G Fundamentals of tool design SME .

REFERENCE BOOKS

1. Cyril Donaldson Tool Design, Tata McGraw Hill.
2. L E Doyle Tool Engineering Prentice Hall.
3. Wellar,J Non-Traditional Machining Processes, SME.

Course Designers

SL.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	C.Thiagarajan	Associate Professor	Mechanical/AVIT	cthiagarajan@avit.ac.in

	METAL FORMING PROCESS	Category	L	T	P	Credit
		CC	2	2	0	3

Prerequisite: -

Course Objective

1	Selection of suitable metal forming techniques
2	Calculation of force in metal forming process
3	Evaluation of different methods and techniques for metal forming applications

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

CO1.	Demonstrate the concepts of theory of plasticity mechanics , stress and temperature distribution and friction in metal forming processes	Understand
CO2.	Apply forging load calculations to evaluate the impact in the process	Apply
CO3.	Analyse various forces and geometrical relationships that occur in a rolling process	Analyze
CO4.	Analyse the extrusion and drawing processes in terms of deformation, lubrication and defects for various applications	Analyze
CO5.	Determine the application of various sheet metal forming methods within the forming limit	Evaluate
CO6.	Analyse the various newer methods and techniques in metal forming process for newer applications	Analyze

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 1	PO 1	PO 1	PS O	PS O	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															
CO7															

S- Strong; M-Medium; L-Low

Syllabus		
Module 1	**Fundamentals of Metal working**	**7**
Classification of Forming Process, Mechanics of Metal working, Flow Stress determination, Temperature in Metalworking, influence of Friction and Lubrication		
Module 2	**Forging**	**7**
Classification of Forging process, Forging equipments, open and closed die forging, Calculation of forging loads , Forging defects		
Module 3	**Rolling**	**7**
Classification of Rolling process, Rolling mills, Hot-Rolling, Cold-Rolling, Forces and Geometrical Relationship in rolling, Rolling defects		
Module 4	**Extrusion and drawing**	**8**
Classification, Process parameters, equipment used, Lubrication and Defects in extrusion process, Analysis of the extrusion process, Hydrostatic extrusion, extrusion of tubing– Defects – applications. Rod and wire drawing, Analysis of wire drawing, Applications		
Module 5	**Sheet-Metal forming**	**7**
Forming Methods, Shearing and blanking, Bending, Stretch forming, Deep drawing, Forming Limit Criteria, Defects		
Module:6	**Advancements in Metal Forming**	**9**
Explosive forming, Electro hydraulic forming, magnetic pulse forming, super plastic forming, electro forming – fine blanking HERF- LASER beam forming-Application of powder metallurgy in forming		

Text Books	
1	B.L.Juneja, (2012), Fundamentals of Metal Forming Processes, New Age International, 2nd Edition
2	Helmi A. Youssef, Hassan A. El-Hofy, Mahmoud H. Ahmed, (2011), Manufacturing Technology: Materials, Processes, and Equipment, CRC Press, Taylor & Francis
Reference Books	
1	George E Dieter , Mechanical Metallurgy,Third Edition Tata McGraw Hill.Education PVT Ltd
2	ASM Hand book, Forming and Forging, Ninth edition
3	ALTAN.T, SOO-IK-oh, GEGEL, HL – Metal forming, fundamentals and Applications, American Society of Metals, Metals Park, Ohio,
4	Marciniak,Z., Duncan J.L., Hu S.J., 'Mechanics of Sheet Metal Forming', Butterworth-Heinemann An Imprint of Elesevier, 2006

5	Heinz Tschaetsch,(2005), Metal Forming Practise, Springer Berlin Heidelberg New York

Course Designers

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

	MODELLING AND ANALYSIS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

Preamble
To provide hands-on experience to the students in analysis software.

Prerequisite
NIL

Course Objective

1	Learn basic procedure of finite element analysis
2	Use computer as a tool in analysis
3	Analysis of modeled parts
4	Analysis of one and two-dimensional problems using software
5	To model multi-dimensional heat transfer problems using ANSYS

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

CO1.	Apply the basic concepts to stress and strain problems for different materials	Understand
CO2.	Solve the finite element problems to trusses, beams and frames	Apply
CO3.	Apply the buckling analysis , Stress analysis of axi-symmetry vessels	Apply
CO4.	Apply Transient thermal conduction and Conductive heat transfer analysis	Apply
CO5.	Solve linear, non-linear and Harmonic analysis problems	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	L	L	-	-	-	-	-	L	M	S	M
CO2	S	S	M	L	S	M	-	-	-	L	-	M	M	M	S
CO3	S	S	S	S	S	M	-	-	M	L	-	L	M	M	S
CO4	S	S	S	M	S	M	-	-	M	L	-	L	M	M	S
CO5	S	S	S	S	S	L	-	-	-	L	-	L	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

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 axi-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	Modelling and Analysis lab Manual

Reference Books

1	Hutton, D.V., "Fundamentals of Finite Element Analysis", McGraw Hill, International Edition, 2004.
2	Chandrupatla, T.R., Belegundu, A.D., "Introduction to Finite Elements in Engineering", Prentice Hall of India, 2002.

Course Designers

S.No.	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	J.SANTHOSH	Assistant Professor	Mech / VMKVEC	santhosh@vmkvec.edu.in

	PROJECT WORK PHASE II	Category	L	T	P	Credit
		CC	0	0	24	12

Prerequisite:Nil

CourseObjective

1	To solve the identified problem based on the formulated methodology.
2	To develop skills to analyse and discuss the test results, and make conclusions.

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	On completion of the project work students will be in a position to take up any challenging practical problem in the field of engineering design and find better solutions to it.	Create

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	A.Elanthirayan	Associate Professor	MECHANICAL/ AVIT	elanthirayan@avit.ac.in

	OPTIMIZATION TECHNIQUES FOR MANUFACTURING	Category	L	T	P	Credit
		CC	2	1	0	3

Preamble

Optimization Techniques is one of the most advanced fields of computer science which involves use of Mathematics, Statistics, Management, Information Technology and Information Sciences in discovering new information and knowledge from large databases and optimize Human effort overall in Decision making process.

Prerequisite-NIL

CourseObjective

1	To learn basic principles of optimization
2	To Study the methods of minimization
3	To apply the constrained optimization techniques
4	To analyze the unconstrained optimization techniques
5	To learn the application of heuristics in optimization

CourseOutcomes:Onthe successfulcompletionofthecourse,studentswillbeableto

CO1.	To understand the formulation and classification of optimization techniques	Understand
CO2.	Solve the problems using the minimization techniques	Apply
CO3.	Apply the direct and indirect methods in optimization techniques	Apply
CO4.	Solve the multi variable unconstrained optimization techniques	Apply
CO5.	Understand the application of heuristics in optimization	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTION TO OPTIMIZATION

Formulation of an optimization problem- Classification of optimization problem – optimization techniques-Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

MINIMIZATION METHODS

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

CONSTRAINED OPTIMIZATION TECHNIQUES

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming

UNCONSTRAINED OPTIMIZATION TECHNIQUES

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, univariate method, pattern search method, steepest descent method and Conjugate gradient method.

APPLICATIONS OF HEURISTICS IN OPTIMIZATION

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization

Text Books

1	Kalyanamoy Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall of India Pvt. 1995.
2	Rao, Singaresu, S., "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2000.

Reference Books

1	Johnson Ray, C., "Optimum design of mechanical elements", Wiley, John & Sons, 1990

2	Goldberg, D.E., "Genetic algorithms in search, optimization and machine", Barnen, Addison-Wesley, New York, 1989.

CourseDesigners

S. No	FacultyName	Designation	Department/ Nameofthe College	Emailid
1.	J.Santhosh	Assistant Professor	Mech/VMKVEC	santhosh@vmkvec.edu.in

ELECTIVE COURSES FOR SEMESTER - 1

	DESIGN FOR MANUFACTURING AND ASSEMBLY	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

To make the students learn about product development, design process, Principles of assembly and Reliability

Prerequisite : NIL

Course Objective

1	Understand the product development cycle.
2	To know the manufacturing issues that must be considered in the mechanical engineering design process.
3	To know the principles of assembly to minimize the assembly time
4	To know the effect of manufacturing process and assembly operations on the cost of product.
5	To be familiar with tools and methods to facilitate development of manufactural mechanical designs

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

CO1.	Recognize the various product development cycle.	Apply
CO2.	Analyzing the manufacturing issues that must be considered in the mechanical engineering design process.	Analyze
CO3.	Analyzing the principles of assembly to minimize the assembly time	Analyze
CO4.	Analyzing the effect of manufacturing process and assembly operations on the cost of product	Analyze
CO5.	Recognize familiar with tools and methods to facilitate development of manufactural mechanical designs.	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	L	-	-	-	-	-	-	-	S	-	-
CO2	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO3	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO4	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO5	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes.

PROPERTIES OF MATERIALS

Properties of Engineering Materials, Selection of Materials – I, Selection of Materials – II, Case Studies – I, Selection of Shapes, Co-selection of Materials and Shapes, Case Studies – II.

MANUFACTURING PROCESSES

Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing, Co selection of Materials and Processes, Case-Studies – III

ASSEMBLY

Design for Assembly, Review of Assembly Processes, Design for Welding – I, Design for Welding – II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies - IV

RELIABILITY

Design for Reliability, Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization.

Text Books

1. M F Ashby and K Johnson, Materials and Design - the art and science of material selection in product design, Butterworth-Heinemann, 2003
2. G Dieter, Engineering Design - a materials and processing approach, McGraw Hill, NY, 2000.
3. M F Ashby, Material Selection in Mechanical Design, Butterworth-Heinemann, 1999.
4. T H Courtney, Mechanical Behavior of Materials, McGraw Hill, NY, 2000.
5. K G Swift and J D Booker, Process selection: from design to manufacture, London: Arnold, 1997

Reference Books

1. S S Rao, Engineering Optimization: theory and practice, John Wiley, NY, 1996.
2. G Boothroyd, P Dewhurst and W Knight, Product design for manufacture and assembly, John Wiley, NY: Marcel Dekkar, 1994.
3. J G Bralla, Handbook for Product Design for Manufacture, McGraw Hill, NY, 1998.
4. Houldcroft, Which Process – an introduction to welding and related processes and guide to their selection, Cambridge, Abington Pub., 1990.
5. ASTM Design handbook.

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	T. Raja	Associate Professor	MECH/VMKVEC	rajat@vmkvec.edu.in
2				

	FLUID POWER AUTOMATION	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

To make the students learn about need for automation , fluid power generating , utilization , controls, regulation elements, hydraulic circuits design and electrical control circuits.

Prerequisite : NIL

Course Objective

1	Understand the need for automation.
2	To know the fluid power generating and utilizing elements
3	To know the principles of control and regulation elements
4	To know the typical industrial hydraulic circuits design.
5	To be familiar with electrical control of pneumatic and hydraulic circuits

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

CO1.	Recognize the various need for automation.	Apply
CO2.	Analyzing the fluid power generating and utilizing elements.	Analyze
CO3.	Analyzing the principles of control and regulation elements	Analyze
CO4.	Analyzing the typical industrial hydraulic circuits design.	Analyze
CO5.	Recognize familiar with electrical control of pneumatic and hydraulic circuits.	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	L	-	-	-	-	-	-	-	S	-	-
CO2	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO3	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO4	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO5	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

FLUID POWER GENERATING/UTILIZING ELEMENTS

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

CONTROL AND REGULATION ELEMENTS

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics-electro hydraulic servo valves-Different types-characteristics and performance.

CIRCUIT DESIGN

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

Text Books

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988
2. Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967

3. Dudbey.A.Peace, Basic Fluid Power, Prentice Hall Inc, 1967

Reference Books

1. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
2. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978.
3. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.

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	R.Venkatesh	Assistant Professor	MECH/VMKVEC	venkatesh@vmkvec.edu.in
2				

	MICRO MANUFCTURING	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

To present the basics of micro machining technology and its applications.

Prerequisite

NIL

Course Objective

1	To learn about the fundamental as well as advanced knowledge of Micro machining Technology.
2	To explain the basic principles and mechanism of Traditional Micro machining and its applications.
3	To illustrate the basic principles and applications of Advanced Micro Machining.
4	To demonstrate the basic principles and applications of different Abrasive based Micro Machining.
5	To illustrate the fundaments of MEMS and its techniques.

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

CO1.	Explain the basic need of Micro Nano Manufacturing in different industries	Understand
CO2.	Summarize the traditional Micro Nano Manufacturing techniques.	Understand
CO3.	Demonstrate and Understand different mechanisms in Advanced Micro Nano Manufacturing.	Apply
CO4.	Utilize the importance of Abrasives in Micro Nano Nano Manufacturing	Apply
CO5.	Identify the need of MEMS in Micro Nano Machining.	Apply
CO6.	Perfom the Nano Manufacturing capabilities in order to diversify and improve manufacturing technology in the region.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O	PS O	PSO 3
CO1	S	L	-	-									S		
CO2	S	L	-	-									S		
CO3	S	M	L	-									S		
CO4	S	M	L	-									S		
CO5	S	M	L	-									S		
CO6	S	S	S	S									S		

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MICRO MACHINING

Need-evolution- fundamentals and trends in micro technologies- Consequences of the technology and society - challenges to manufacturing technology-evolution of precision in manufacturing, tooling and current scenario - Micro materials, fabrication tools, requirements and applications.

TRADITIONAL MACHINING

Theory of micro machining – Chip formation – Size effect in micro machining – Micro turning - Micro milling - Micro drilling - Micro machining tool design – Precision Grinding – Partial ductile mode grinding – Ultra precision grinding.

ADVANCED MICRO MACHINING

Introduction-Classification - Mechanical Micromachining (AJM, USM)-Thermal Micromachining (EDM, LBM, EBM)-Electrochemical and Chemical Micromachining-Ion Beam Machining-Photochemical Etching

ABRASIVE BASED MICRO MACHINING

Abrasive Flow Finishing (AFF) -Magnetic Abrasive Finishing (MAF)-Magnetorheological Finishing - Magnetorheological Abrasive Flow Finishing - Elastic Emission Machining (EEM) and Magnetic Float Polishing

MEMS

Introduction to MEMS, Definitions and classifications-History – applications - MEMS Market - Bulk Micro machining - Wet and Dry Etching - Surface Micromachining – Chemical –Vapor Deposition – Lithography - Wafer Bonding.

Text Books:

1	V.K.Jain, Introduction to Micromachining, Narosa publishing House, New Delhi.
2	Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture," McGraw-Hill, 2008.

Reference Books:

1	J. Paulo Davim, Mark J. Jackson (2009) Nano and Micromachining, John Wiley &
2	V. K. Jain (2012), Micromanufacturing Processes, CRC Press.
3	Mohamed Gad-el-Hak (2010) MEMS Introduction and Fundamentals, CRC Press.

Course Designers

Sl.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	C.THANGAVEL	ASSOCIATE PROFESSOR	Vinayaka Mission's Kirupananda Variyar Engineering College	thangavel@vmkvec.edu.in
2				

	QUALITY AND RELIABILITY ENGINEERING	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

To expose the students to the various quality control techniques and to understand the importance and concept of reliability

Prerequisite : NIL

Course Objective

1	To Understand the techniques of Quality & Process Control
2	To Understand process control and acceptance sampling procedure and their application.
3	To study about the various Design process and to learn about Taguchi Method.
4	To Learn the Concepts of Reliability.
5	To analyze the process involved in Design for Reliability.

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

CO1.	Understand the Various techniques of Quality & Process Control	Understand
CO2.	Understand the process control and acceptance of sampling procedure and their application.	Understand
CO3.	Analyze the various Design process and to learn about Taguchi Method	Analyze
CO4.	Analyze the various Concepts of Reliability Techniques.	Analyze
CO5.	Analyze the various process involved in Design for Reliability	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	L	-	-	-	-	-	-	-	S	-	-
CO2	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO3	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO4	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO5	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

QUALITY & STATISTICAL PROCESS CONTROL

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

ACCEPTANCE SAMPLING

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

EXPERIMENTAL DESIGN AND TAGUCHI METHOD

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

CONCEPT OF RELIABILITY

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

DESIGN FOR RELIABILITY AND MAINTAINABILITY

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

Text Books

1. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers
2. Statistical Quality Control by M. Mahajan, Dhanpat Rai & Co. (P) Ltd.
3. Quality Control & Application by B. L. Hanson & P. M. Ghare, Prentice Hall of India
4. Total Quality Management by Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield and Mary Besterfield-Sacre, Pearson Educaiton
5. Reliability Engineering by Srinath L. S., Affiliated East West Press.

Reference Books

1. Amata Mitra “Fundamentals of Quality Control and improvement” Pearson Education, 2002.
2. Bester field D.H., “Quality Control” Prentice Hall, 1993.
3. Patrick D To’ connor, Practical Reliability Engineering, John-Wiley and Sons Inc, 2002
4. Charles E Ebling, An Introduction to Reliability and Maintability Engineering, Tata-McGraw Hill, 2000.
5. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.
6. Dhillon, Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008.

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	S. Raja	Assistant Professor	MECH/VMKVEC	rajas@vmkvec.edu.in
2				

ELECTIVE COURSES FOR SEMESTER - 2

	FINITE ELEMENT APPLICATIONS IN MANUFACTURING	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

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

CourseObjective

1	Understand finite element analysis fundamentals and formulations
2	Study the basics of element properties natural, Triangular & rectangular and one dimensional analysis in solid mechanics and heat transfer.
3	Formulation of finite element methods for Two dimensional solids.
4	Formulate the truss, beam and frame problems and Development of code for one dimensional analysis and validation.
5	Formulation of finite element methods for the analysis of heat transfer , effect of plasticity and fracture in solids , Finite Element analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency and welding

CourseOutcomes:Onthe successfulcompletionofthecourse,studentswillbeableto

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 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 mechanicsproblems use finite element methods.	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

SYLLABUS

INTRODUCTION

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

ONE DIMENSIONAL ANALYSIS

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

COMPUTER IMPLEMENTATION

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

ANALYSIS OF PRODUCTION PROCESSES

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

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	Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,1985.

2	Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3	Zienkiewicz, O.C., "Finite Elements and Approximation", Dover International, 2006.
4	Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990
5	Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
6	Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.
7	www.tbook.com
8	www.pollockeng.com

	INDUSTRIAL ERGONOMICS	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

Adapting the requirements of a job to the physical needs of the humans who perform it**.**

Prerequisite : NIL

Course Objective

1	To optimize the integration of man and machine in order to increase productivity with accuracy
2	To enhance human performance, control fatigue and prevent accidents.
3	To increase the safety, comfort and performance of a product or an environment, such as an office
4	To understand the environmental ergonomics includes which lighting, noise and vibration, heating and ventilation, platform motion
5	To take into account metabolic cost, measurement and prevention of work strain, and other ergonomic factors in the design of tasks and workplaces.

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

CO1.	Understand ergonomics with human comfort point of view	Understand
CO2.	Analyse the degree of protection against dangerous exposures, whether chronic or acute.	Analyse
CO3.	Apply the concept of ergonomics design in equipment	Apply
CO4.	Understand environmental ergonomic factors Room temperature, illumination, noise, indoor air quality, relative humidity	Understand
CO5.	Apply work measurement and work improvement techniques like stop watch time study, work sampling, method study	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	-	-	-	-	-	-	-	-	-	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

INTRODUCTION **9**

Concepts of human factors engineering and ergonomics – Man – machine system and design philosophy – Physical work – Heat stress – manual lifting – work posture – repetitive motion.

ANTHROPOMETRY **10**

Physical dimensions of the human body as a working machine – Motion size relationships – Static and dynamic anthropometry – Anthropometric aids – Design principles – Using anthropometric measures for industrial design – Procedure for anthropometric design.

DESIGN OF SYSTEMS **10**

Displays – Controls – Workplace – Seating – Work process – Duration and rest periods – Hand tool design – Design of visual displays – Design for shift work.

.

ENVIRONMENTAL FACTORS IN DESIGN **10**

Temperature – Humidity – Noise – Illumination –Vibration – Measurement of illumination and contrast – use of photometers – Recommended illumination levels. The ageing eye – Use of indirect (reflected) lighting – cost efficiency of illumination – special purpose lighting for inspection and quality control – Measurement of sound – Noise exposure and hearing loss – Hearing protectors – analysis and reduction of noise – Effects of Noise on performance – annoyance of noise and interference with communication – sources of vibration discomfort.

WORK PHYSIOLOGY **8**

Provision of energy for muscular work – Role of oxygen physical exertion – Measurement of energy expenditure Respiration – Pulse rate and blood pressure during physical work – Physical work capacity and its evaluation.

Reference Books

1. Martin Helander, A guide to the ergonomics of manufacturing, East West press, 1996
2. E.J. McCormic, Human factors in engineering design, McGraw Hill 1976
3. R.S. Bridger Introduction to Ergonomics, McGraw Hill, 1995.

Course Designers

S.No	Faculty Name	Designation	Department/Name of the College	Email id
1	Dr.P.Sellamuthu	Associate Professor	MECH/VMKVEC	sellamuthu@vmkvec.edu.in

	LEAN MANUFACTURING	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble
This course provides a technological knowledge for elimination or reduction of waste during manufacturing process, thereby saving materials and also contribute for a green environment.

Prerequisite –NIL

Course Objective

1	To provide knowledge of manufacturing processes with special attention to reduction of waste.
2	To make the students understand the difference between mass production and lean production.
3	To develop skills for handling mechanical tools, testers and equipments.
4	To develop skills in handling work sequence in different machines.
5	To develop skills in elimination of waste using 5S techniques.

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

CO1	To know about mechanical manufacturing processes using powered machines.	Remember
CO2	To differentiate between mass production and lean production	Understand
CO3	To describe working on machines using optimum conditions.	Apply
CO4	To demonstrate processes used for value creation on finished products.	Apply
CO5	To demonstrate procedures used for avoiding errors and mistakes.	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	S	-	-	-	-	-	S	S	S
CO2	S	S	-	-	-	S	S	S	-	-	-	-	S	S	S
CO3	S	S	S	-	-	S	S	S	-	-	S	-	S	S	S
CO4	S	S	-	-	S	S	S	S	-	-	S	-	S	S	S
CO5	S	S	-	-	-	S	S	S	-	-	S	-	S	S	S

S- Strong; M-Medium; L-Low

Syllabus

UNIT I – CONCEPTS OF LEAN MANUFACTURING - 9 HOURS

Lean process, 3M concept, Key principles and implications of lean manufacturing, Traditional vs Lean manufacturing characteristics, Roadmap for Lean implementation and Lean benefits, Study of Ford and Toyota production system, JIT manufacturing, Lean building blocks.

UNIT II – ADDING VALUE AND REDUCTION OF WASTE - 9 HOURS

Value creation and waste elimination, Types of waste, Pull production and different models, The Kanban system, Continuous flow and Continuous improvement process, Kaizen - Worker involvement, Design of Kanban quantities, Leveled production, Tools for continuous improvement.

UNIT III - JIT, COMPOSITE PART AND CASE STUDIES - 9 HOURS

JIT with cell manufacturing, Part families, Production flow analysis, Composite part concept, Machine cell design, Quantitative analysis, Case studies, Single piece flow.

UNIT IV - VALUE STREAMING AND SIX SIGMA - 9 HOURS

The value stream – Benefits and Mapping process. The Current state map– Mapping icons, Mapping steps, VSM exercises, TAKT time calculations. Six Sigma – Definition, Statistical considerations, Variability reduction, Design of experiments, Six Sigma implementation.

UNIT V - WORK SEQUENCE, MISTAKE PROOFING AND WASTE ELIMINATION - 9 HOURS

Standardized work – Standard work sequence, Timing and working progress. Quality at source – Automation / JIDOKA, Visual management system, Mistake proofing / Poka-Yoke. 5S technique – Elements and waste elimination through 5S, Advantages and Benefits, 5S Audit. Visual control aids for improvement, Flexible work force.

TOTAL: 45 HOURS

Text Books

1.	Toyota Production System -An integrated approach to Just in Time – Yasuhiro Monden, – Engineering aild Management Press -Institute of Industrial Engineers – 1983.
2.	James P Womack, Daniel T Jones, and Daniel Roos, The Machine that changed the World. The Story of Lean Production - Harper Perennial edition published 1991.
3.	Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy, Second Edition Hardcover – 2012 by Masaaki Imai.
4.	Value Stream Mapping: How to Visualize Work and Align Leadership for Organizational Transformation Paperback – 2016 by Karen Martin , Mike Osterling.
5.	Lean And Six Sigma – Six Sigma Black Belt (2007 BOK): Enterprise-Wide Deployment Paper Back by Suvabrata Mitra.

Reference Books

1.	Learning to See: Value Stream Mapping to Add Value and Eliminate MUDA 1st Edition by Mike Rother and John Shook.
2.	Getting the Right Things Done: A Leader's Guide to Planning and Execution by Dennis, Pascal (January 1, 2006) by Pascal Dennis.
3.	The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer by Jeffrey K. Liker.

Course Designers

S.No	Faculty Name	Designation	Department / Name of the College	Email id
1	Dr. Sanjay Singh	Professor	Mech / VMKVEC	sanjay@vmkvec.edu.in

	MATERIALS MANAGEMENT AND LOGISTICS	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

This course provides to understand how material management should be considered for profitability and to learn the need and importance of logistics in product flow.

Prerequisite : NIL

Course Objective

1	To ensure understanding of the growth of the organization
2	To gain application knowledge of the surplus capacity of the organization, such as physical facility , man power, etc.
3	To apply knowledge of application in the utilization of surplus fund of the organization.
4	To gain applicability knowledge in new requirement of the customers.
5	To analyze ways to increase company's market share and to target new market segment.
6	To ensure analysis capability in complete product range in company's portfolio.

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

CO1.	Understand the scope of operations function in industrial and business organizations and various elements of it from its management point of view	Understand
CO2.	Understand the scope of Purchasing policies, procedures and Seller relationship.	Understand
CO3.	Understand the Stores function, Materials handling and Network analysis point of view	Understand
CO4.	Apply demand forecasting, Material Requirement Planning (MRP) & managing materials levels.	Apply
CO5.	Apply specific type of inventory system and Aggregate Planning system for the given product category and type	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

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

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions.

MANAGEMENT OF PURCHASE

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

MANAGEMENT OF STORES AND LOGISTICS

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

MATERIALS PLANNING

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

INVENTORY MANAGEMENT

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system.

Text Books

1. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
2. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.
3. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.

Reference Books

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003
3. Dr. R. Kesavan, C.Elanchezian and T.SundarSelwyn, Engineering Management – Eswar Press – 2005

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	S.DURAITHILAGAR	Associate Professor	MECH/VMKVEC	duraithilagar@vmkvec.edu.in
2				

	MICRO ELECTRO MECHANICAL SYSTEMS AND NANO TECHNOLOGY	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

- This course to gives thorough knowledge about the trends in latest manufacturing technologies of Micro Electro Mechanical Systems and also measuring systems to nano scale in Nano Technology. The fabrication processes for development of MEMS devices and systems. Also to impart knowledge to the students about nano materials and various nano measurements techniques.

Prerequisite : NIL

Course Objective

1	To understand the broad knowledge of the history, over view, applications and future directions of MEMS.
2	To understand the various materials and fabrication techniques about MEMS.
3	Identify the suitable applications for sensors and actuators in MEMS.
4	Develop the thorough knowledge of the Nano structures and fabrication process in Nano Technology.
5	To understand the advanced characterization techniques of Nano materials in Nano Technology.

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

CO1.	Understand the concepts of MEMS, over view, applications and Future directions of MEMS.	Understand
CO2.	Select suitable materials and fabrication process for MEMS technology.	Apply
CO3.	Select for suitable applications in sensors and actuators in MEMS.	Apply
CO4.	Understand the Nano materials and structures in Nano Technology.	Understand
CO5.	Select the suitable characterizations techniques of Nano materials and Nano Technology.	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	-	-	-	-	-	-	-	-	-	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

INTRODUCTION OF MEMS AND MICROSYSTEMS **7**

Unique characteristics of MEMS, Microsystems Technology- An Overview, typical MEMS and Microsystem Products. Scaling laws in miniaturization- Application of MEMS and Microsystems- Future Directions of MEMS.

MATERIALS AND FABRICATION PROCESSES **10**

Structure of silicon and other materials, - Mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS. Silicon wafer processing - Bulk micromachining and Surface micromachining, Wafer-bonding. Thin-film deposition, Lithography, wet etching and dry etching. LIGA and other moulding techniques- Soft lithography and polymer processing- Thick-film processing; Low temperature co-fired ceramic processing- Smart material processing.

MICRO SENSORS AND MICRO-ACTUATORS **10**

Micro sensors - Basic principles and working of micro sensors- Acoustic wave micro sensors. Bio-medical micro sensors- Bio-sensors- Chemical micro sensors – Optical Sensors – Pressure micro sensors- Thermal micro sensors-acceleration micro sensors; Micro actuators - Basic principles and working of micro actuators- Electrostatic micro actuators- Piezoelectric micro actuators- Thermal micro actuators- SMA micro actuators- Electromagnetic micro actuators, micro valves, micro pumps.

SCIENCE OF NANO MATERIALS **9**

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Nanoparticles, Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nano tubes – Solid carbon source based production techniques – Gaseous carbon source based production techniques. Top down processes – bottom up process.

CHARACTERIZATION OF NANO MATERIALS **9**

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

Reference Books

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
4. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.
5. Guozhong Cao, “Nanostructures and Nanomaterials: Synthesis, Properties, and Applications”, World Scientific Publishing Private, Ltd., 2011.
6. Zhong Lin Wang, “Characterization of Nanophase Materials”, Wiley-VCH, 2004.
7. Carl. C Koch, “Nanostructured Materials: Processing, Properties and Potential Applications”, William Andrew Publishing Norwich, 2006.
8. Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods,John Wiley & Sons, 2013.

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	S. Arunkumar	Assistant Professor	MECH/VMKVEC	arunkumar@vmkvec.edu.in

	NON-DESTRUCTIVE TESTING AND EVALUATION	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

To stress the importance of NDT in engineering.

Prerequisite : NIL

Course Objective

1	To impart knowledge on Visual Inspection & Liquid Penetrant Testing
2	To understand the behavior of eddy current testing & acoustic emission
3	To understand the selection of Magnetic Particle Testing & Thermography
4	Develop the thorough knowledge of Ultrasonic Testing & Radiography
5	To understand the case studies, comparison and selection of NDT methods

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

CO1.	Understand the concepts of elastic, Visual Inspection & Liquid Penetrant Testing	Understand
CO2.	Analyse the behavior of eddy current testing & acoustic emission	Analyse
CO3.	Select for suitable applications in Magnetic Particle Testing & Thermography.	Apply
CO4.	Understand the Ultrasonic Testing & Radiography.	Understand
CO5.	Select case studies, comparison and selection of NDT 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	-	-
CO2	S	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

NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING **6**

Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications.Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications

EDDY CURRENT TESTING & ACOUSTIC EMISSION **9**

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications.Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures

MAGNETIC PARTICLE TESTING & THERMOGRAPHY **10**

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

ULTRASONIC TESTING & RADIOGRAPHY **10**

Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C-Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks. Principle of Radiography, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography

CASE STUDIES, COMPARISON AND SELECTION OF NDT METHODS **9**

Case studies on defects in cast, rolled, extruded, welded and heat treated components.Comparison and selection of various NDT techniques. Codes, standards, specification and procedures.

Reference Books

1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., "Practical Non Destructive Testing" Narosa publishing house, New Delhi, 2002
2. Krautkramer. J., "Ultra Sonic Testing of Materials", 1st Edition, Springer – Verlag Publication, New York, 1996.
3. Peter J. Shull "Non Destructive Evaluation: Theory, Techniques and Application" Marcel Dekker, Inc., New York, 2002

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	M SENTHIL KUMAR	ASSISTANT PROFESSOR	MECH/VMKVEC	senthil@vmkvec.edu.in

	ROBOT DESIGN & PROGRAMMING	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

This course provides and creates a base for the students to develop concepts of Robotics

Prerequisite : NIL

Course Objective

1	To understand importance and anatomy of the robot.
2	To provide an in-depth study of robot kinematics and dynamics.
3	To develop skills for robot programming.
4	To develop criticizing skills for robot programming and AI.
5	To analysis sensors and actuators in robotic applications.

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

CO1.	To get knowledge of the mechanical structures of robots and grippers also will learn about basic terminology of the robots.	Remember
CO2.	To understand the kinematic and dynamic characteristics of the robot.	Understand
CO3.	Able to programming the robots using different techniques	Apply
CO4.	To apply the programming with the robots.	Analysis
CO5.	To analysis the different actuators and sensors for the robotic applications	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	M	L	L	-	-	-	-	-	-	-	S	-	-
CO2	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO3	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO4	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-
CO5	S	S	S	M	M	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

History of robots, Classification of robots, Present status and future trends. Basic components of robotic system. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Mechanical grippers-Slider crank mechanism, Screw type, Cam type gripper, Magnetic grippers, Vacuum grippers, Air operated grippers; Specifications of robot.

KINEMATICS AND DYNAMICS OF ROBOTS

2D, 3D Transformation, Scaling, Rotation, Translation, and Homogeneous coordinates, multiple transformations, Simple problems. Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneous Transformations, Inverse kinematics of Robot, Robot Arm dynamics, D-H representation of robots, Basics of Trajectory Planning.

ROBOT PROGRAMMING

Robot programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-Interlock commands operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands.

VAL LANGUAGE

Robot Languages-Classifications, Structures- VAL language commands motion control, hand control, program control, pick and place applications, palletizing applications using VAL, Robot welding application using VAL program-WAIT, SIGNAL and DELAY command for communications using simple applications. VAL-II programming-basic commands, applications- Simple problem using conditional statements-Simple pick and place applications-Production rate calculations using robot**.**

ROBOT SENSORS AND ACTUATORS

Design of Robots – characteristics of actuating systems, comparison, microprocessors control of electric motors, magnetostrictive actuators, shape memory type metals, sensors, position, velocity, force, temperature, pressure sensors – Contact and non contact sensors, infrared sensors, RCC, vision sensors.

Text Books

1. Groover, M.P., Weiss, M., Nagel, R.N., Odrey, N.G. and Dutta, A., 2012. Industrial robotics: technology, programming, and applications. McGraw-Hill.
2. Fu, K.S., Gonzalez, R. and Lee, C.G., 1987. Robotics: Control Sensing. Vis. Tata McGraw-Hill Education.

Reference Books

1. Siciliano, B., Khatib, O. and Kröger, T. eds., 2008. *Springer handbook of robotics* (Vol. 200). Berlin: springer.
2. Gordon Mair, 'Industrial Robotics', Prentice Hall (U.K.) 1988
3. Niku, S.B., 2001. *Introduction to robotics: analysis, systems, applications* (Vol. 7). New Jersey: Prentice hall.
4. Klafter, R.D., Thomas, A.C. and Negin, M., 1989. Robotic Engineering: An Integarted Aproach
5. Mckerrow, P., 1991. Introduction to robotics. Addison-Wesley Longman Publishing Co., Inc..

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. Natarajan	Associate Professor	Mechanical Engineering / VMKVEC	natarajans@vmkvec.edu.in
2				

ELECTIVE COURSES FOR SEMESTER - 3

	ADDITIVE MANUFACTURING	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:-Nil

CourseObjective

1	Understand the principles, methods, areas of usage, possibilities and limitations and the environmental effects of the additive manufacturing technologies
2	Develop a comprehensive understanding of fundamental additive manufacturing
3	Identify some of the important research challenges associated with AM and its data processing tools
4	Select a design for-additive manufacturing skillset for CAD and CAM methodologies to produce successful 3D prints.
5	Fabricate 3D mechanical objects using a variety of 3D printing technologies

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Understand the operating principles, capabilities and limitations of liquid and solid based additive manufacturing system including fused deposition modelling and Stereolithography	Understand
CO2.	Understand the operating principles, capabilities and limitations of powder based additive manufacturing system including 3d printing and laser sintering	Understand
CO3.	Describe the differences and the application of a range of additive manufacturing process.	Apply
CO4.	Selection and utilization of correct CAD formats in the manufacture of a 3d printed part	Apply
CO5.	Describe the important process parameters and suitable additive technique for other manufacturing systems	Apply

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**Introduction**	9
Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits- Applications		
Module 2	**Reverse Engineering and CAD modelling**	9
Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modelling techniques: Wire frame, surface and solid modelling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.		
Module 3	**Liquid based and solid based Additive Manufacturing systems**	9
Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning,recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modelling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies		
Module 4	**Powder based Additive Manufacturing systems**	9
Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.		
Module 5	**Other Additive Manufacturing systems**	9
Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.		
TextBooks		
1	Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications : A tool box for prototype development", CRC Press, 2011	
2	Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press	
ReferenceBooks		
1	Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers,	

2	Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003
3	Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010
4	Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	DR.S.SANGEETHA	Associate Professor	Mech/AVIT	sangeethas@avit.ac.in

	COMPOSITE MATERIALS	Category	L	T	P	C
		EC	3	0	0	3

PREAMBLE

This course reviews the various composite materials their processing techniques and their behaviors , and to develop models and their applications in aerospace, automotive and medical fields

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To study about Fibre reinforced Plastics
2	To study the manufacturing processes of the composite materials
3	To study about macro mechanical behavior of FRP
4	To study about micromechanical behavior of composite materials
5	To study about material models of composites

COURSE OUTCOMES

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

Know the types of reinforcements and fibers used in composite materials	Understand
CO2. Know the various manufacturing techniques in composite manufacturing	Understand
CO3. Able to test the macro mechanical behavior of Fiber Reinforced Plastics	Analyze
CO4. Able to test the Micro mechanical behavior of Fiber reinforced plastics	Analyze
CO5. Make models for solving the composite material manufacturing	Apply

COS	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	**S**	-	**L**	-	-	**M**	**S**	-	-	-	-	-	**L**		
CO2	**S**	-	**L**	-	-	**L**	**S**	-	-	-	-	-	**L**		
CO3	**S**	**S**	**S**	**S**	**L**	**L**	**S**	-	-	-	-	-	**L**		
CO4	**S**	**S**	**S**	**S**	**L**	**L**	**S**	-	-	-	-	-	**L**		
CO5	**S**	**S**	**S**	**S**	**S**	**L**	-	-	-	-	-	-	**L**		

S- Strong M-Medium L- Low

Syllabus

FIBRE REINFORCED PLASTICS (FRP)

Definition; Types; General properties and characteristics; Reinforcing materials – particles, fibers,

whiskers; Properties of reinforcing materials; Matrix materials; Additives; Properties of FRP materials; Applications

MANUFACTURING PROCESSES

Open mold processes – Hand layup, Spray up, Vacuum bag, Pressure bag & autoclave, Centrifugal casting,Filament winding; Closed mold processes – Compression molding, Resin transfer molding (RTM), Injection molding, Pultrusion; SMC & DMC products, etc.

MACROMECHANICAL BEHAVIOR OF FIBRE REINFORCED PLASTICS

Design variables; Selection of fiber-matrix and manufacturing process; Effects of mechanical, thermal, electrical and environmental properties, Fiber orientation, Symmetric and asymmetric structure; Effects of unidirectional continuous and short fibers; Lamination theory; Failure theories.

MICROMECHANICAL BEHAVIOR OF FIBRE REINFORCED PLASTICS

Strengthening methods, Elasticity of fibre composites, Plasticity and fracture of composites, Crack propagation in fibre composites, Failure under compressive loads.

MATERIAL MODELS

Law of Mixtures, Shear lag model,Laminated plate model, Eshelby's models, Other models.

Text Books:

1. Haslehurst.S.E., "Manufacturing Technology ", ELBS, London.

2. Krishnan K. Chawle. "Composite Material: Science and Engineering" Second Edition, Springer.

Reference:

1.. T.W.Clyne, P.J. Withers, "An Introduction to metal matrix composites", Cambridge University Press.

2. F.C. Campbell "Structural Composite Materials", Materials Park,ASM International,2010

Course Designers

S. No.	Name of the Faculty	Designation	Department / Name of the College	Mail ID
1	**Dr.D.Bubesh Kumar**	**Associate Professor**	**Mechanical/ AVIT**	**bubeshkumarmech@gmail.com**

	COMPUTER AIDED PRODUCT DESIGN	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:Nil

CourseObjective

1	To Know about computer aided modelling& Software
2	To Understand various Computer graphics and model.
3	To Know about computer Product Design and Management
4	To understand Design tools and techniques
5	Understand the concept of product development & Design Technique.

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Describe the new Engineering Design and Various Phases involved.	Understand
CO2.	Learn various wireframe and surface modeling techniques used for generating computer models.	Understand
CO3.	Have knowledge about product Design and design Management.	Apply
CO4.	Have knowledge about various Product models and different metric used	Apply
CO5.	Understand contemporary issues and their impact on provided solution. And use of Design technique	Apply

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**INTRODUCTION**	9
Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design anddrafting.Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing		
Module 2		9
Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves - Geometric Modeling – types,Graphics standards – assemblymodeling – use of software packages		
Module 3	**PRODUCT DESIGN CONCEPTS AND DATA MANAGEMENT**	9
Understanding customer needs – Product function modeling – Function trees and function structures– Product tear down methods – Bench marking – Product port folio – concept generation andselection – Product Data Management – concepts – Collaborative product design– manufacturingplanning factor – Customization factor – Product life cycle Management.		
Module 4	**PRODUCT DESIGN TOOLS & TECHNIQUES**	9
Product modeling – types of product models; product development process tools – TRIZ – Altshuller'sinventive principles – Modeling of product metrics – Design for reliability – design for manufacturability– machining, casting, and metal forming – design for assembly and disassembly.		
Module 5	**PRODUCT ARCHITECTURE AND DESIGN TECHNIQUES**	9
Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions. Taguchi method of DOE – Quality loss functions – Design for product life cycle.		

TextBooks	
1	Biren Prasad, "Concurrent Engineering Fundamentals Vol.11", Prentice Hall, 1997.
2	Ibrahim Zeid, "CAD/CAM theory and Practice", Tata McGraw Hill, 1991.

ReferenceBooks	
1	David F.Rogers.J, Alan Adams, "Mathematical Elements for Computer Graphics", McGraw Hill,1990.
2	James G.Bralla, "Handbook of Product Design for Manufacturing", McGraw Hill, 1994
3	Mikell P Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", 4th Edition, Pearson

4	M. Groover and E. Zimmers, "CAD/CAM Computer-Aided Design and Manufacturing", 1st Edition, Pearson Education,

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	G ANTONY CASMIR	Assistant Professor	Mech/AVIT	antonycasmir@avit.ac.in
2				

	EMERGING MATERIALS	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble

The aim of the subject is to make students understand the properties, processing, manufacturing of various emerging materials and their applications

Prerequisite - NIL

Course Objective

1	To understand the classification of Engineering Materials and their relevant applications.
2	To understand the powder metallurgy concepts, process techniques, applications.
3	To understand the basics in composites, fabrication methods, types and applications.
4	To understand the various forms of Smart Materials, applications.
5	To understand the various types of Nano-material's, production & applications.

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

CO1.	To understand classification of Materials and its applications.
CO2.	Know the concepts of powder Metallurgy and its techniques.
CO3.	To know the different types of composites.
CO4.	To understand the concepts of Smart Materials
CO5.	To obtain the knowledge of Nano Materials and its applications

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	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	S	L	L	L	M	M							L		
CO2	S	L	L	L	M	M							L		
CO3	S	L	M	M	M	L							L		
CO4	S	L	M	L	M	M							L		
CO5	S	L	S	M	M	M							L		

S- Strong; M-Medium; L-Low

SYLLABUS

ENGINEERING MATERIALS – CONVENTIONAL Classification of engineering materials- Metallic materials-ferrous materials-steel & cast iron and non ferrous materials – aluminium and copper. Non-Metallic materials – glasses , ceramics ,Polymer and plastics – their characteristics and unique properties- Material for structural applications - Light weight structural materials for automobiles and aero plane applications .

POWDER METALLURGY – POWDER SYNTHESIS

Powder Metallurgy – Near net shaping process methods and principles - chemical methods – electro-chemical methods - atomization – mechanical alloying – rapid solidification – processing – Nano size powders. Powder physical and chemical characterization – process characteristics - Applications.

COMPOSITE MATERIALS

Composites – Types of composites - Naturally occurring, synthetic & engineered composites - MMC – CMC – PMC - Fibre and whisker reinforced composites (continuous and discontinuous) - particulate composites layered or sheet composites, composite coating or thin fibre, inter metallic composites - properties and characteristics of composites

SMART MATERIALS

Introduction to intelligent/smart materials, shape memory alloys-types, NiTiNol-origin, properties, martensitic transformation, Memorization process- applications-medical, satellite etc

NANO MATERIALS

Nanomaterials-Definition, Classification of Nanostructured materials, causes of interest in nanomaterials, applications of nanomaterials. Processes for producing ultrafine powders-mechanical grinding, wet chemical synthesis of nanomaterials. Gas phase synthesis of Nano materials, gas condensation processes, chemical vapour condensation, laser ablation

TEXT BOOKS

1. 11. Budinski, Kenneth G, Budinski, Michael K, Engineering Materials: Properties and Selection, 9th Edition, PHI.
2. M.V.Gandhi., Thomson - Smart Materials and Structures- Chapman and Hall.
3. A.K.Bandhopadyay-Nanomaterials-New Age

Reference Books

1. 1. 1. Srinivasan.K, Composite Materials, Narosa Publishing House.
2. Ramesh, Nanomaterials: Mechanics and Mechanisms, Springer Verlag, EPZ, Paperback edition.
3. Angelo P.C., Subramanian R., Powder Metallurgy, Science, Technology and Applications, Prentice Hall of India

Course Designers

S.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	C.THIAGARAJAN	ASSISTANT PROFESSOR (GRADE-II)	Mechanical/AVIT	cthiagarajan@avit.acc.in

	MANUFACTURING MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite–NIL

CourseObjective

1	To select the plant location, material handling system and construct the plant layout
2	Tomake use of the work study and work measurement
3	Todevelop an ability to forecast the demand and to create work sheet
4	To identify the Project network analysis
5	Apply the principles of marketing management

CourseOutcomes:Onthesuccessfulcompletionofthecourse,students willbeableto

CO1.	Select the plant layout and Identify the Appropriate material handling system	Understand
CO2.	Illustrate method study and value analysis	Understand
CO3.	Demonstrate market research and sales promotion techniques	Understand
CO4.	Examine various production planning strategies	Understand
CO5.	Apply the knowledge to develop Process planning ,scheduling and forecasting	Apply
CO6.	Apply the skills in develop project network and construct critical path	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus

MODULE 1	PLANT ENGINEERING AND FACILITY PLANNING	9

Plant location – Factors affecting plant location – Techniques – Plant layout - principles - Types – Comparison of layouts – Materials handling – Principles – Factors affecting selection of Materials handling system – Types of materials handling systems – Techniques. Facility planning – Factors affecting selection of plant location, Factor rating analysis: Break event, Load distance model, closeness ratings.

MODULE 2	**WORK STUDY**	4
Method study – Principles of motion economy – steps in method study – Tool and Techniques – Work measurement – Purpose – stop watch time study – Production studies – work sampling – Ergonomics – Value analysis		
MODULE 3	**PROCESS PLANNING AND FORECASTING**	9
Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing – Forecast errors.		
MODULE 4	**PRODUCTION PLANNING & CONTROL**	9
Steps in PPC process mapping, preparation of process mapping and feedback control for effective monitoring. Aggregate production planning, production planning strategies, Disaggregating the aggregate plan, Materials Requirement Planning (MRP), MRP-II, Supply chain management, Operation scheduling, prioritization.		
MODULE 5	**SCHEDULING AND PROJECT MANAGEMENT**	5
Scheduling – Priority rules scheduling – sequencing – Johnson's algorithm for job sequencing – n job M machine problems – Project Network analysis – PERT/CPM – Critical path –Floats – Resource leveling – Queuing analysis.		
MODULE 6	**PERSONNEL AND MARKETING MANAGEMENT**	9
Principles of Management – Functions of personnel management – Recruitment – Training – Motivation – Communication – conflicts – Industrial relations – Trade Union – Functions of marketing – Sales promotion methods – Advertising – Product packaging – Distribution channels – Market research and techniques		

Text Books

1	R. Pannererselvam, "Production and Operations Management", 3rd Edition, PHI, 2012.
2	Dr. R. Kesavan, C. Elanchezian and T.Sundar Selwyn, Engineering Management – Eswar Press, Chennai – 2005
3	Martand T. Telsang, Production Management, S.Chand& Co., 2005

ReferenceBooks

1	Thomas E Mortan, Production and Operations Management, Vikas Publications, 2003.
2	KanishkaBedi, "Production and Operations Management", 2nd Edition, Oxford Higher Education, 2007.
3	S. N. Chary, "Production and Operations Management", 4th Edition, SIE, TMH, 2009.

CourseDesigners

S.No	FacultyName	Designation	Department /Nameofthe College	Emailid
1	A.IMTHIYAS	ASST.PROF	MECH/ AVIT	imthiyas@avit.ac.in
2				

	MANUFACTURING SYSTEMSIMULATION	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:Simulation modeling& analysis

CourseObjective

1	Define the basics of simulation modeling and replicating the practical situations in organizations
2	Generate random numbers and random variates using different techniques.
3	Design and Develop simulation model using heuristic methods.
4	Analysis of Simulation models using input analyzer, and output analyzer
5	Explain Verification and Validation of simulation model.

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Explain the concepts and principles of technology manufacturingsystemsimulation	Understand
CO2.	Describe the role of important elements of discrete event simulation and modeling paradigm	Analyze
CO3.	Design and evaluate a given manufacturing system using simulation	Analyze
CO4.	Generate random numbers and variants to execute a simulation model	Analyze
CO5.	Evaluate queuing networks and algorithms in the context of manufacturing	Understand

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**INTRODUCTION**	9
Basic concept of system – elements of manufacturing system – concept of simulation – simulation as a decision making tool – types of simulation – system modeling – types of modeling.		
Module 2	**RANDOM NUMBERS**	9
Probability and statistical concepts of simulation – Pseudo random numbers – methods of generating random numbers – discrete and continuous distribution – testing of random numbers – sampling – simple, random and simulated		
Module 3	**DESIGN OF SIMULATION EXPERIMENTS**	9
Problem formulation – data collection and reduction – time flow mechanical – key variables – logic flow chart starting condition – run size – experimental design consideration – output analysis, interpretation and validation – application of simulation in engineering industry.		
Module 4	**ANALYSIS OF SIMULATION DATA**	9
Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.		
Module 5	**QUEUING POLICIES, ALGORITHMS AND CASE STUDIES**	9
Introduction to basic Single – pass heuristics, meta-heuristics and applications – Application of Genetic algorithms and Ant colony based algorithms in Discrete event simulation models with simple examples.		

TextBooks	
1	Banks J. and Carson J.S., Nelson B.L., "Discrete event system simulation", 4th Edition, Pearson., United Kingdom, 2005
2	Geoffrey Gordon, "System Simulation", second edition, Prentice Hall, India, 2005

ReferenceBooks	
1	Kalechman M., "Practical MATLAB" basics for engineers", CRC press.,Taylor and Francis group, First
2	Schriber T.J., "Simulation using GPSS", John Wiley, 2002. 2. Law A.M. and Kelton W.D., "Simulation
3	Shannon R.E., "systems simulation – The art and Science", Prentice Hall., India, 1975.
4	Fishwick P.A., "Imulation Model Design and Execution : Building Digital Worlds" New Jersey: Prentice Hall Int"l Inc., India, 1995.
5	A.M. law and Kelton W.D., "Simulation Modeling and Analysis" .2nd Edition, New York: McGraw Hill Inc., United States, 1991.

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	M. Saravanakumar	Asst Professor	Mech/AVIT	saravanakumar@avit.ac.in

2				

	MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:None

CourseObjective

1	On completion of the course the students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis
2	On completion of the course the students are expected to be knowledgeable in electron microscopy
3	On completion of the course the students are expected to be knowledgeable in Chemical Thermal Analysis
4	On completion of the course the students are expected to be knowledgeable in static mechanical testing methods
5	On completion of the course the students are expected to be knowledgeable in dynamic mechanical testing methods

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Interpret various materials characterization techniques.	Understand
CO2.	Understand the principle and operation of characterization equipment and the adjustment of operation variables to obtain good images / results	Understand
CO3.	Understand the concept of Chemical and Thermal Analysis	Apply
CO4.	Understand the principle of Mechanical Testing – Static Tests	Apply
CO5.	Understand the principle of Mechanical Testing – Dynamic Tests	Analyze

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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	L	-	-	-	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	-	-

S-Strong;M-Medium;L-Low

Syllabus

Module 1	**Micro and Crystal Structure Analysis**	9

Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction ,Bragg's law – Techniques of X-ray Crystallography, Debye ,Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

Module 2	**Electron Microscopy**	9

Scanning Electron Microscopy (SEM) - Introduction, Instrumentation, Contrast formation, Operational variables, Specimen preparation, imaging modes, Applications, Limitations.

Module 3	**Chemical and Thermal Analysis**	9

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra-Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Thermo Gravity metric Analysis (TGA),Differential Scanning Calorimetry (DSC).

Module 4	**Mechanical Testing – Static Tests**	9

Codes and standards for testing metallic and composite materials. Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test ,Tensile Test – Stress – Strain plot – Proof Stress, Torsion Test - Ductility Measurement – Impact Test – Charpy&Izod – DWTT - Fracture Toughness Test,

Module 5	**Mechanical Testing – Dynamic Tests**	9

Fatigue – Low & High Cycle Fatigues, Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Testsmodal analysis - Applications of Dynamic Tests.

TextBooks

1	Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, (3rd Edition). Prentice Hall, 2001.
2	Dieter G.E., Mechanical Metallurgy, (3rd Edition), ISBN: 0070168938, McGraw Hill, 1988.

ReferenceBooks

1	ASM Hand book-Materials characterization, Vol – 10, 2004.
2	Morita.S, Wiesendanger.R, and Meyer.E, ―Non-contact Atomic Force Microscopy‖ Springer, 2002,
3	Grundy P.J. and Jones G.A., Electron Microscopy in the Study of Materials, Edward Arnold Limited, 1976.
4	Newby J., Metals Hand Book- Metallography & Micro Structures, (9th Edition), ASM International, 1989
5	Goldsten,I.J., Dale.E., Echin.N.P.& Joy D.C., Scanning Electron Microscopy & X rayMicro Analysis, (2nd Edition), ISBN – 0306441756, Plenum Publishing Corp., 2000.

CourseDesigners

S.No	**FacultyName**	**Designation**	**Department/ College**	**Emailid**
1	S.ASHOKKUMAR	Assistant professor (Gr-II)	Mech/AVIT	ashokkumar@avit.ac.in
2				

		Category	L	T	P	Credit
	MECHATRONICS	**EC**	**3**	**0**	**0**	**3**

Prerequisite:Nil

CourseObjective

1	To provide overview of need and benefits of mechatronics in manufacturing
2	To know the basic working principle of sensors and transducers of use for manufacturing systems
3	To know the basic working principle of drives and actuators of use for manufacturing systems
4	To know the features, modules and interfaces of microcontrollers and microprocessors
5	To gain the knowledge of mechatronic systems in design process and case studies

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Infer the knowledge to study the mechatronics in manufacturing systems.	Understand
CO2.	Identify and select the sensors and transducers based on the application.	Apply
CO3.	Identify the principles and functions of drives and actuators.	Apply
CO4.	Distinguish between microprocessor and microcontrollers and its functions	Analyse
CO5.	Categorize the various stages of design in mechatronics systems	Analyse

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**Introduction**	7
Introduction to Mechatronics-systems – Mechatronics approach to modern engineering and design – History of Mechatronics-Scope and Significance of Mechatronics systems- Elements of Mechatronics systems–Subsystems of Mechatronics -Emerging areas of Mechatronics-Classification of Manufacturing based onMechatronics- Need and benefits of Mechatronics in Manufacturing		
Module 2	**Sensors and Transducers**	11
Introduction – Performance Terminology – Potentiometers – Strain gauges – LVDT – Eddy current sensor – Hall effect sensor – Resistive Transducers – Inductive Transducers-Capacitance Transducers – Digital transducers – Temperature sensors – Optical sensors – Piezo electric sensor-Ultrasonic sensors – Proximity sensors – Chemical and Gas Sensors-Signal processing techniques.		
Module 3	**Drives and Actuators**	9
Classification of actuators-Role of Linear and Rotary Actuators – Electrical actuators –Servo motors and Stepper motors -Piezoelectric actuators-Solenoids-D.C. Motors–Function of Drives-Solid state relays-Mechanical Switching Devices-Interfacing with microcontroller through H-bridge Circuits		
Module 4	**Microprocessors and Microcontrollers**	11
Introduction – Requirement for Processor – Comparison of 8085 Microprocessor and 8051 Microcontrollers– 8051 Microcontrollers Architecture, PIC Microcontrollers (16f xxx) series – Assembly language programming-Instruction sets, Instruction format, Addressing modes, Basic programing-Interfacing-Sensors, Keyboards, LCD, LED, A/D and D/A Converters-Actuators – Embedded Systems RS 232 serial communication interface, classification of memories.		
Module 5	**Mechatronic Systems**	7
Design Process-Stages of design in mechatronics systems – Traditional and Mechatronics design concepts – Case studies – Pick and place robots, Automatic car parking system, Automatic camera, Automatic washing machine, Engine management system, Machinery automation.		

TextBooks

1	Vijayaraghavan G.K., Balasundaram M S, Ramachandran K P, Mechatronics: Integrated Mechanical Electronic Systems, Wiley, 2008.
2	R.K.Rajput.A Text Book of Mechatronics, Chand &Co, 2007

ReferenceBooks

1	Bolton W, **—** Mechatronics: Electronic control systems in mechanical and electrical engineering, 6thedition, Pearson Education Limited, 2015.
2	Devadasshetty, Richard A. Kolk, Mechatronics System Design, Cengage Learning, 2011.
3	BenoBenhabib, Manufacturing, design, production, automation and integration, Marcel Dekker, 2003
4	Mazidi M A and Mazidi J G, 8051 Microcontroller and Embedded Systems, 2002.

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	B.SELVA BABU	Assistant Professor	Mech/AVIT	selvababu @avit.ac.in

2				

	NANO STRUCTURED MATERIALS AND ITS APPLICATIONS	Category	L	T	P	Credit
		EC	3	0	0	3

Preamble
To develop the knowledge of students in nano-structured materials.

Prerequisite
NIL

Course Objective

1	The objective of this course is to make the students familiar with the different methods of synthesis for nano-materials.
2	To motivate the students to understand the evolution of nano-materials in the scientific era.
3	To understand different processing methods and properties of nano-materials.
4	To explore knowledge about the different nanoporus materials.
5	To provide the various applications of nano-materials for future engineering applications

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

CO1.	Understand the basics of nano materials, types, various structures of nano materials and its applications	Understand
CO2.	Understand the various synthesis process of nano-materials, methods and various chemical approaches.	Understand
CO3.	Understand the various physical approach methods and techniques involved in the process of nano-materials.	Understand
CO4.	Applications and types of various nano porus materials.	Apply
CO5.	Analyze the various nano-materials and its principle and design.	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	S									
CO2	S				M	M									
CO3	S				M	M									
CO4	S				M	M							L		
CO5	S		M		L	M							M		M

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION TO NANO STRUCTURED MATERIALS

0D, 1D, 2D structures –Size Effects –Fraction of Surface Atoms –specific Surface Energy and Surface Stress –Effect on the Lattice Parameter –Phonon Density of States–the General Methods available for the Synthesis of Nanostrutures –precipitative –reactive –hydrothermal/solvothermal methods –suitability of such methods for scaling –potential Uses.

BULK SYNTHESIS AND CHEMICAL APPROACHES

Top down and bottom up approaches–Mechanical alloying and mechanical ball milling- Mechano chemical process, Inert gas condensation technique – Arc plasma and laser ablation, Sol gel processing-Solvo thermal, hydrothermal, precipitation, Spray pyrolysis, Electro spraying and spin coating routes, Self-assembly, self-assembled monolayers (SAMs). Langmuir-Blodgett (LB) films, micro emulsion polymerization- templated synthesis, pulsed electrochemical deposition.

PHYSICAL APPROACHES

Vapor deposition and different types of epitaxial growth techniques (CVD,MOCVD, MBE,ALD)- pulsed laser deposition, Magnetron sputtering - lithography :Photo/UV/EB/FIB techniques, Dip pen nanolithography, Etching process :Dry and Wet etching, micro contact printing.

NANOPOROUS MATERIALS

Zeolites, mesoporous materials, nanomembranes - Carbon nanotubes and graphene - Core shell and hybrid nanocomposites.

APPLICATION OF NANOMATERIALS

Overview of nanomaterials properties and their applications, Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications – Quantum Devices – Nanomechanics - Photonics- Nano structures as single electron transistor –principle and design.

Text Books

1	Guozhong Cao ,"Nanostructures and Nanomaterials , synthesis , properties and applications" ,Imperial College Press ,2004.
2	Carl C. Koch (ed.), " Nanostructured Materials", Processing, Properties and Potential Applications, Noyes Publications, Norwich, New York, U.S.A.
3	Bhusan, Bharat (Ed), "Springer Handbook of Nanotechnology", 2nd Edition, 2007.

Reference Books

1	Modern Physics – Beiser 6th edition 2009.
2	Quantum Mechanics - Bransden and Joachen 2nd edition 2000.
3	Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles, 2nd Edition by Eisberg, Robert; Resnick, Robert, 1985.
4	Quantum Physics – Theory and application, Ajoy Ghatak, Springer 2004.
5	Principles of Quantum Mechanics 2nd ed. - R. Shankar 2000.
6	Quantum Mechanics - Vol 1&2 - Cohen-Tannoudji,1997.

Course Designer

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1.	A.SENTHILKUMAR	AP-II	MECH/AVIT	senthilkumar@avit.ac.in

	PROCESS PLANNING AND COST ESTIMATION	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:Nil

CourseObjective

1	To introduce the process planning concepts to make estimation for various products, process planning and its approaches
2	To impart the Knowledge about the job order and techniques involved in shop floor
3	To introduce the cost estimation concept to analysis the expense and determination of other cost
4	To impart knowledge on cost estimation of a product by considering various manufacturing processes.
5	To facilitate estimation of time for machining, welding, forging and allied processes

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Select the process, equipment and tools for various industrial products, prepare process planning activity chart	Understand
CO2.	Compute the job order cost for different type of shop floor	Apply
CO3.	Identify the cost estimation concept – Overhead Cost, Expense & depreciation Techniques.	Apply
CO4.	Calculate the time taken for various machining operations, apply appropriate methods for calculating depreciation	Analyze
CO5.	Identify the various cost elements involved in total cost of the product - welding, casting and forging operations	Analyze

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**INTRODUCTION TO PROCESS PLANNING**	9
Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection-. Production equipment and tooling selection– Types of chart techniques		
Module 2	**INTRODUCTION TO COST ESTIMATION**	9
Estimation of Different Types of Jobs - Cost estimation: Importance and aims of cost estimation - functions of estimation - difference between estimating and costing - importance of preparing realistic estimates - estimating procedure. Elements of cost, Objectives		
Module 3	**COST ESTIMATION CONCEPT**	9
Elements of costs - ladder of cost - determination of material cost - labour cost - expenses. Analysis of overhead expenses, Distribution of overhead costs – depreciation - causes of depreciation - methods of calculating depreciation		
Module 4	**MACHINING COST ESTIMATION**	9
Estimation of machining time, Calculation of machining time for lathe operations-estimation of drilling time on drilling machine - estimation of time for shaping, planning, milling and grinding.		
Module 5	**PRODUCTION COST ESTIMATION**	9
Costing for metal forming and fabrication processes, Estimation of cost in welding- Estimation in forging shop - cost estimation of foundry work.		

TextBooks	
1	Banga T. R. and Sharma S. C. - ‘Mechanical Estimating and Costing including Contracting” - Khanna Publishers - 2011
2	Sinha.B.P., "Mechanical Estimating and Costing", Tata McGraw-Hill, Publishing Co.2002

ReferenceBooks	
1	Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002
2	Russell.R.S and Tailor, B.W, "Operations Management", PHI, 4th Edition
3	Chitale.A.V. and Gupta.R.C., "Product Design and Manufacturing", PHI, 2nd Edition
4	K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, Khanna Publishers 1990
5	Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”, Pearson Education 2001.

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	Dr.S.Prakash	Assistant Professor (Gr II)	Mech/AVIT	prakash@avit.ac.in
2				

	PRODUCT DESIGN AND DEVELOPMENT	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:

CourseObjective: Understand the application of product design methods to develop a product

1	To enable the students to gain knowledge on the process of product development and concept selection
2	To enable the students to understand the Product architecture and system level design issues
3	To make the students to familiarize with the Industrial design process
4	To enable the students to understand the Planning for prototypes and Elements of economic analysis
5	To Understand the background inManaging Product Development Projects

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1.	Explain the basic product development process	Remember
CO2.	Recall the design process for product development	Understand
CO3.	Apply the industrial design process and manufacturing Cost	Apply
CO4.	Analyze the design principles of prototyping and Economic Analysis	Analyze
CO5.	Analyze the Project Budget and Project evaluation- patents	Analyze

Mappingwith ProgrammeOutcomesandProgrammeSpecificOutcomes

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	-	-

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**Product Development and Concept Selection**	9
Significance of product design, product design and development process, sequential engineering design method, the challenges of product development – Product development organizations- Identifying the customer needs – Establishing the product specifications – concept generation – Concept selection.		
Module 2	**Product Architecture**	9
Concept Testing, Response and Interpretation. Product Architecture, Implication of the architecture – Establishing the architecturePlatform planning, System level design issues. Embodiment design, Modelling.		
Module 3	**Industrial and Manufacturing Design**	9
Need for industrial design – Impact of industrial design – Industrial design process. Assessing the quality of industrial design- Human Engineering consideration - Estimate the manufacturing cost – Reduce the component cost – Reduce the assembly cost – Reduce the support cost – Impact of DFM decisions on other factors		
Module 4	**Prototyping and Economic Analysis**	9
Principles of prototyping – Planning for prototypes - Elements of economic analysis – Base case financial model – Sensitivity analysis – Influence of the quantitative factors		
Module 5	**Managing Product Development Projects**	9
Sequential, parallel and coupled tasks - Baseline project planning – Project Budget Project execution – Project evaluation- patents- patent search-patent laws International code for patents.		

TextBooks	
1	G. E. Dieter, Engineering Design, McGraw – Hill International, 2013.
2	Ken Hurst, Engineering Design Principles, Elsevier Science and Technology Books, 2014.

ReferenceBooks	
1	Charles Gevirtz, Developing New products with TQM, McGraw – Hill International editions, 1994
2	Karal .T. Ulrich, Steven D.Eppinger, Product Design and Development, McGRAW-HILL International Editions.2003.
3	S.Rosenthal, Effective product design and development, Irwin 1992.
4	Karl Ulrich and Steven Eppinger, “Product Design and Development”, 5th edition, 2016

CourseDesigners				
S.No	**FacultyName**	**Designation**	**Department/ College**	**Emailid**
1	Mr.SATHIYARAJ S	Assistant Professor G-II	Mech/AVIT	sathiyaraj@avit.ac.in
2				

	PRODUCT LIFECYCLE MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

Prerequisite:Nil

CourseObjective

1	To impart the latest knowledge, principles, strategies, practices, and applications in PLM domain
2	To provide an in-depth understanding of various applications and solutions of PLM.
3	Apply PLM concepts for service industry and E-Business.
4	To build conceptual foundation of PLM, along with the latest industry views on PLM applications.
5	To present frameworks which provide economic justifications for PLM projects.

CourseOutcomes:On thesuccessfulcompletionof thecourse,studentswillbeableto

CO1	Understand product data, information, structures and PLM concepts	Understand
CO2	Apply PLM systems in organization verticals including production, after sales, sales and marketing, and subcontracting.	Apply
CO3	To Apply the concepts of e – Manufacturing in Industrial sectors and Digital Manufacturing	Apply
CO4	Apply and design the various strategies for process and product data management.	Analyse
CO5	Configure organisations, product structures, workflow, projects and requisite tasks in PLM.	Apply

MappingwithProgrammeOutcomesandProgrammeSpecificOutcomes

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

S-Strong;M-Medium;L-Low

Syllabus		
Module 1	**Fundamentals of PLM**	9
Product data or Product information, Product lifecycle management concept, Information models and product structures-Information model, The product information (data) model, The product model, Reasons for the deployment of PLM systems.		
Module 2	**Enterprise solution with PLM**	9
Use of product lifecycle management systems in different organization verticals, Product Development and Engineering, Impact of Manufacturing with PLM Challenges of product management in Engineering and Manufacturing Industry, Life cycle thinking.		
Module 3	**PLM for e-Manufacturing**	9
Significance of product management, Collaborative Manufacturing, Integration of the PLM system with other applications: Different ways to integrate PLM systems, Transfer file, Database integration, System roles, ERP, Optimization of ERP for PLM and CAD.		
Module 4	**Technology Forecasting**	9
Future mapping, invocating rates of technological change, methods of technology forecasting such as relevance trees, morphological methods and mission flow diagram, combining forecast of different technologies, uses in manufacture alternative.		
Module 5	**PLM Solutions**	9
Human resources in product lifecycle, Methods, Techniques, Phases of product lifecycle and corresponding technologies, Enterprise information, knowledge and IP, Change Process, Product Structure & Configuration, Project, Engineering Process, Information Standards, Vendors of PLM Systems and Components.		

TextBooks

1	Jaya Krishna S, Product Lifecycle Management: Concepts and cases, ICFAI Publications 2011.
2	Grieves, Michael, Product Lifecycle Management, McGraw-Hill, 2006.

ReferenceBooks

1	Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006.
2	Kari Ulrich and Steven D. Eppinger, Product Design & Development, McGraw Hill International Edns, 1999.
3	Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realization, SpringerVerlag, 2004
4	AnttiSaaksvuori, AnselmiImmonen, Product Life Cycle Management - Springer

CourseDesigners

S.No	FacultyName	Designation	Department/ College	Emailid
1	Praveen R	Asst. Prof – II	Mech. / AVIT	praveen@avit.ac.in

OPEN ELECTIVE COURSES

	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

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UNIT II- IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT III – Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

UNIT IV – Domain specific applications of IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT V – Reflection, Low-Level Programming

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

TEXT BOOKS

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

REFERENCES

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

COURSE DESIGNERS

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

	GREEN POWER GENERATION SYSTEMS	Category	L	T	P	Credit
		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

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

	NEW VENTURE PLANNING AND MANAGEMENT	Category	L	T	P	Credit
		OE	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	

	Operations Research

Category	L	T	P	Credit
OE	2	2	0	3

Preamble

Operations Research is the study of optimization techniques. It is applied in decision theory. Rapid development and invention of new techniques occurred since the World War II essentially, because of the necessary to win the war with the limited resources available. It is applied for solving 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 Objectives

1. Develop linear programming problems and find solutions of LPP and apply in management decisions
2. To acquire knowledge of linear programming, assignment and transportation problems
3. Techniques of PERT, CPM and sequencing
4. Detailed knowledge of Inventory control
5. Decision theory and Game theory techniques

Course Outcomes

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

CO1.Formulate the LPP. Conceptualize the feasible region. Solve the LPP with two variables using graphical method and By simplex method.	Understand& Apply
CO2. Become familiar with the types of problems that can be solved by applying a transportation model. Be able to identify the special features of the assignment problem.	Apply
CO3. Solve network problems using CPM and PERT techniques and apply sequencing model	Apply
CO4. Determine the order quantity.Determine the reorder point and safety stock forinventory systems.Design a continuous or periodic review inventorycontrolsystem..	Apply
CO5. Apply replacement models .To makedecisionsinacompetitive Environmentisaverycommonandimportantone.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1.	S	M	L	--	S	--	--	S	--	--	--	--
2.	S	M	L	--	S	--	--	S	--	--	--	--
3.	S	M	L	--	S	--	--	S	--	--	--	--
4.	S	S	L	--	M	--	--	S	--	--	--	--
5.	S	S	L	--	M	--	--	S	--	--	--	--

S- Strong; M-Medium; L-Low

Syllabus

LINEAR PROGRAMMING

Linear programming problem – Graphical method - Simplex method – Big M method – Duality principle.

TRANSPORTATION MODEL

Transportations problem – Assignment problem – Under Assignment -Travelling salesman problem

NETWORK MODEL

Project Network – CPM and PERT Networks – Critical path scheduling – Sequencing Models.

INVENTORY MODELS

Inventory Model – 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).

DECISION MODEL

Decision Model – Game theory – Two Person Zero sum game – Algebraic solutions Graphical solutions – Replacement model – Model based on Service life – Economic life single / multivariable search technique.

Text Books

1. H.A.Taha, "Operations Research",Prentice Hall of India , 1999, Six Edition.
2. KantiSwarup,P.K.Gupta,Man Mohan, SultanChand& Sons, New Delhi(2010)

Reference Books

1. Sundarasen.V, Ganapathysubramaniyam . K.S. Ganesan.K. "Operations Research" ,A.R. Publications
2. Premkumar Gupta, Hira, "Operations Research" Chand & company New Delhi.

Assessment Pattern/Assessment Methods

Bloom's Category	Continuous Assessment Tests			Terminal Examination
	1	2	3	
Remember	20	10	10	0
Understand	20	30	30	30
Apply	60	60	60	70
Analyse	0	0	0	0
Evaluate	0	0	0	0
Create	0	0	0	0

Course Designers:

S.No	Name of the Faculty	Mail ID
1	V.T.Lakshmi	lak_msc@yahoo.co.in
2	S.Punitha	puni.jeeju80@gmail.com

	PROJECT MANAGEMENT FOR ENGINEERING BUSINESS AND TECHNOLOGY	Category	L	T	P	Credit
		OE	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

MANDATORY/ AUDIT COURSES

Course Code	Course Title	Category	L	T	P	C
	English for Research Paper Writing	**HSS**	**2**	**0**	**0**	**0**

Course Objectives:

1. To understand research problem formulation.
2. Need to analyze research related information
3. Evaluate and Follow research ethics

Unit I Research

Meaning of research problem - Sources of research problem- Criteria Characteristics of a good research problem - Errors in selecting a research problem - Scope and objectives of research problem

Unit II Data Analysis

Approaches of investigation of solutions for research problem - data collection, analysis, interpretation - Necessary instrumentations

Unit III Plagiarism

Effective literature Reviews - approaches, analysis Plagiarism – Definition of Plagiarism – Consequences of Plagiarism – Unintentional Plagiarism – Forms of Plagiarism - Related Issues - Research ethics

Unit IV Research Paper Format

Effective technical writing, how to write report, Paper Developing a Research Proposal

Unit V Format

Format of research proposal – Margin – Text Formatting - Heading and Title – Page Numbers –Tables and Illustrations – Corrections and Insertions –Binding – Bibliography

Total: 45 Periods

References:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

COURSE DESIGNERS			
COURSE INSTRUCTOR	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**
Dr. Premkishor	Assistant Professor	AVIT	PREM.ENGLISH@avit.ac.in
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	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
			3	1	0	0

PREAMBLE

PREREQUISITE

NIL

COURSEOBJECTIVES

1	To study about the Disaster Management Cycles
2	To Study about the Disaster Community and planning
3	To Understand the Challenges posed by Disasters to the community
4	To study about coping concepts for both natural and man made disasters
5	To study about strengthening techniques for structural and non structural measures

COURSEOUTCOMES

Onthesuccessfulcompletionofthecourse,students willbeableto

CO1. Understanding Disasters, man-made Hazards and Vulnerabilities	Understandand Apply
CO2. Understanding disaster management mechanism	Apply
CO3 To gain knowledge about organizations involved in disaster community	Apply
CO4. To build skills to respond to disasters	Apply
CO5. Understanding capacity building concepts and planning of disaster managements	UnderstandandApply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

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

S-Strong;M-Medium;L-Low

SYLLABUS

UNIT I INTRODUCTION

Overview of Disaster Management – Distinguishing between an emergency and a Disaster situation. Disaster Management Cycle – Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans- Phase I: Mitigation, and strategies; hazard Identification and vulnerability analysis. Disaster Mitigation and Infrastructure, impact of disasters on development programmes, vulnerabilities caused by development, developing a draft country-level disaster and development policy Phase II: Preparedness, Disaster Risk Reduction(DRR), Emergency Operation Plan (EOP) Phases III and IV: Response and recovery, Response aims, Response Activities, Modern and traditional responses to disasters, Disaster Recovery, and Plan

UNIT IIDISASTER PLANNING

Disaster Planning-Disaster Response Personnel and duties, Community Mitigation Goals, Pre-Disaster Mitigation Plan, Personnel Training, Volunteer Assistance, School-based Programmes, Hazardous Materials, Ways of storing and safely handling hazardous materials, Coping with Exposure

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UNIT III DISASTER COMMUNITY

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

UNIT IVCOPING WITH DISASTER

Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT VCAPACITY BUILDING

Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Ayaz,. “Disaster Management: Through the New Millennium”, Anmol Publications. (2009)
3. Dave, P. K.. “Emergency Medical Services and Disaster Management: A Holistic Approach”, New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2009
4. Disaster Management by Mrinalini Pandey Wiley 2014.
5. Goel, S. L., “Disaster Management”, New Delhi: Deep & Deep Publication Pvt. Ltd. ,2008

REFERENCES:

1. Narayan, B. “Disaster Management”, New Delhi: A.P.H. Publishing Corporation ,2009
2. Kumar, N.. “Disaster Management”. New Delhi: Alfa Publications. ,2009
3. Ghosh, G. K., “Disaster Management”, New Delhi: A.P.H Publishing Corporation. , References

S.No	NameoftheFaculty	Designation	NameoftheCollege	MailID	
1	MrsJ.Srija	Assistant Professor - I	AVIT	srija.civil@avit.ac.in	

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

Course Objectives:

On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

Course Content

UNIT I

The Constitution - Introduction

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure - Fundamental Rights and Fundamental Duties – Directive Principles State Policy

UNIT II –Government of the Union

The Union Executive- Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha

UNIT III –Government of the States

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

UNIT IV – Local Government

The New system of Panchayats ,Municipalities and Co-Operative Societies

UNIT V – Elections

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

TEXTBOOKS AND REFERENCE BOOKS:

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008
2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)
3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition
Suggested.

Total Hours: 30 hours

Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html

2. http://www.legislative.gov.in/constitution-of-india

3. https://www.sci.gov.in/constitution

4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of india/ **Alternative NPTEL/SWAYAM Course:**

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

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