GIET UNIVERSITY, GUNUPUR, ODISHA

DEPARTMENT OF MECHANICAL ENGINEERING

SCHOOL OF ENGINEERING & TECHNOLOGY

Incorporated by Act 23 of Govt. of Odisha and under approval of UGC & AICTE

Accredited by NAAC with a CGPA of 3.28/4 at *A+ Grade*

Seven UG Programs CSE, ME, CHE, AEIE,ECE,BT & EEE Accredited by NBA

Gunupur - 765022 , Dist.- Rayagada, Odisha, INDIA

www.giet.edu

COURSE STRUCTURE AND SYLLABUS

FOR

POST GRADUATE DEGREE COURSE

IN

MANUFACTURING TECHNOLOGY

REGULATION -2019

GIET UNIVERSITY, GUNUPUR, ODISHA

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Structure of Postgraduate Engineering Program

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER								TOTAL CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management Courses	-	-	-	-					
2	Basic Science Courses	-	-	-	-					
3	Engineering Science Courses including workshop, drawing, basics of electrical mechanical/computer etc.	-	-	10	16					**26**
4	Professional Core Courses	12	12	-	-					**24**
5	Professional Elective Courses relevant to chosen specialization / branch	6	6	3	-					**15**
6	Open subjects - Electives from other technical and/or emerging Subjects	-	-	3	-					**3**
7	Project work, Seminar and Internship in industry or elsewhere	-								
8	Mandatory Courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]	-	-	-	-					
	TOTAL	**18**	**18**	**16**	**16**					**68**

I SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC		Composite Materials	3			3
2	PC		Casting and Welding Technology	3			3
3	PC		Research Methodology and IPR	2			2
4	PE-1		Fatigue, Creep & Fracture	3	0	0	3
			CAD / CAM				
			Production Automation & CNC Technology				
			Materials Technology				
5	PE-2		Machine Tool Technology	3	0	0	3
			Computer Integrated Manufacturing				
			Press Tools in Metal Forming				
			Micro and Nano Manufacturing				
6	PC		Advance manufacturing lab			4	2
7	PC		Metallurgy and Non-destructive testing laboratory			4	2
8	Audit		Audit course - I	2			0
TOTAL				12	2	8	18

II SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC		Metal Cutting – Theory and Practice	3			3
2	PC		Advanced Manufacturing Processes	3			3
3	PE-3		Rapid Manufacturing Processes	3			3
			Manufacturing Management				
			Welding Application Technology				
			Material selection and safety				
4	PE-4		Finite Element Method	3			3
			Manufacturing of products from non metalic materials				
			Precision Engineering				
			High Speed Machining				
5	PC		Metal Cutting Lab			4	2
6	PC		Advance welding Lab			4	2
7	Audit		Audit course-II	2			0
8	PC		Mini-project			4	2
TOTAL				12	2	8	18

III SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	OE		Industrial Safety	3	0	0	3
			Human Resource Management				
			Project Management And Costing				
			Optimization Techniques				
2	PE-5		Flexible Manufacturing Systems	3	0	0	3
			Robotics				
			Mechanical Drives				
			Theory of Plasticity				
PRACTICAL / SESSIONAL							
3	ES		Dissertation Phase-I	0	0	20	10
TOTAL				6	0	20	16

IV SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
PRACTICAL / SESSIONAL							
1	ES		Dissertation Phase-II	0	0	32	16
TOTAL				0	0	32	16

Audit course 1 &2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

I SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC		Composite Materials	3			3
2	PC		Casting and Welding Technology	3			3
3	PC		Research Methodology and IPR	2			2
4	PE-1		Fatigue, Creep & Fracture	3	0	0	3
			CAD / CAM				
			Production Automation & CNC Technology				
			Materials Technology				
5	PE-2		Machine Tool Technology	3	0	0	3
			Computer Integrated Manufacturing				
			Press Tools in Metal Forming				
			Micro and Nano Manufacturing				
6	PC		Advance manufacturing lab			4	2
7	PC		Metallurgy and Non-destructive testing laboratory			4	2
8	Audit		Audit course - I	2			0
TOTAL				12	2	8	18

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	COMPOSITE MATERIALS	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1	Explain the basic properties of matrix material and reinforcing materials.
CO2	Analyze the macro-mechanical behavior of fiber reinforced plastics.
CO3	Interpret the micro-mechanical behavior of fiber reinforced plastic
CO4	Select the suitable manufacturing technology to fabricate FRP.

CO-PO & PSO Mapping

Cos	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2												3	
CO2	2	1											2	
CO3	2	2											2	
CO4	3												3	
Avg.	2.25	0.75											2.5	

SYLLABUS

UNIT- I : FIBRE REINFORCED PLASTICS (FRP) (14 Hours)

Definition; Types; General properties and characteristics; Reinforcing materials – particles, fibers, whiskers; Properties of reinforcing materials; Matrix materials; Additives; Properties of FRP materials; Applications.

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.

UNIT -II: MICROMECHANICAL BEHAVIOR OF FIBRE REINFORCED PLASTICS (13 Hours)

Strengthening methods, Elasticity of fibre composites, Plasticity and fracture of composites, Crack propagation in fibre composites, Failure under compressive loads. Law of Mixtures, Shear lag model, Laminated plate model, Eshelby's models .

UNIT- III: MANUFACTURING PROCESSES (12 Hours)

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.

Teaching Methods: Chalk& Board
TEXT BOOKS 1. Robert M. Jones " Mechanics of Composite Material" Taylor and Francis, 2010. 2. Krishnan K. Chawle. "Composite Material: Science and Engineering" Second Edition, Springer, 2010 T.W.Clyne, P.J. Withers, "An Introduction to metal matrix composites", Cambridge University Press, 1993.
REFERENCE BOOKS 1. F.C. Campbell "Structural Composite Materials", Materials Park,ASM International,2010. 2. Haslehurst.S.E., "Manufacturing Technology ", ELBS, London, 1990.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	CASTING AND WELDING TECHNOLOGY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Illustrate different casting methods in association with core making and mould design.
CO2	Explain the process of melting and quality control aspect of casting.
CO3	Outline different metal joining processes and demonstrate the concept welding metallurgy
CO4	Evaluate the techniques for Inspection and testing of welded/cast products.

CO-PO & PSO Mapping

Cos	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1											2	
CO2	2	1	1										1	
CO3	3	1												
CO4	2	2												
Avg.	2.25	1.25	0.25										0.75	

SYLLABUS

UNIT- I : (13 Hours)

Core making processes - design for moulding and casting - different moulding and casting processes-function of the gating system-permanent mould casting-centrifugal casting investment casting-mercast casting-continuous casting-low pressure casting.

Melting and quality control of various steels and non-ferrous alloys , casting defects, fettling, inspection and testing of castings, Manufacturing of Cast irons, Design for casting.

UNIT- II : (12 Hours)

Arc welding power sources-Different arc welding processes-solid state welding process soldering, Brazing and adhesive bonding , metal surfacing and spraying, thermal cutting processes. Welding metallurgy – weldability criteria , Different types of joint configuration, different types of welding position-design of weldments and joints.

UNIT- III : (13 Hours)

Inspection and testing of welding and casting – Defects, Destructive tests, Non destructive testing techniques, surface treatments-safety aspects in welding processes, specific welding applications and innovations.
Teaching Methods: Chalk& Board
TEXT BOOKS 1. Dr.R.S.Parmar "Welding processes and technology" Khanna Publishers. third edition. 2. Scrope Kalpakjian,, "Manufacturing processes for Engineering Materials", Pearson , fifth edition
REFERENCE BOOKS 1. K.C. John " Metal casting and Joining" , PHI Publishers, 2015- edition. 2. H.S.Bawa " Manufacturing Technology-I" Tata Mc Graw Hill Publishers New Delhi, 2007-edition.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	RESEARCH METHODOLOGY AND IPR	**2**	**0**	**0**	**2**	

Pre -Requisite:

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1	Understand research problem formulation and analyze research related information
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4	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.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1												
CO2	2	2	1											
CO3	3	2						1						
CO4	3		2					1						
Avg.	2.75	1.25	0.75					0.5						

SYLLABUS

UNIT:1 (14 Hours)

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 Effective literature studies approaches, analysis Plagiarism, Research ethics,

UNIT:2 (13 Hours)

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

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:3 (13 Hours)

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

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.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"2001
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"2002
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 2008.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
9. Technological Age", 2016.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	FATIGUE, CREEP & FRACTURE	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: Upon successful completion of this course, students should be able to:

CO1	Be familiar with the fatigue development and Influence of stress concentration under fatigue strength.
CO2	Understand and able to analyze Mechanism of creep and it effects in design components.
CO3	Interface various modes of fracture under different Theories.
CO4	Ability to conduct an experimental analysis on different materials subjected to creep, fatigue and fracture mechanisms.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2												
CO2	1	2	1											
CO3	1	2												
CO4	1	2		1										

Avg.	1.25	2.0	0.25	0.25										

SYLLABUS

UNIT -1 (12 Hours)

Fatigue: Types of fatigue loading and failure, Fatigue test, endurance limit; Fatigue under combine stresses; Influence of stress concentration on fatigue strength, Notch sensitivity, Factors influencing fatigue behaviour.

UNIT:2 (12 Hours)

Creep: Creep-stress-time temperature relations, Mechanics of creep in tension, bending, torsion, creep buckling. Members subjected to creep and combined stresses.

UNIT:3 (12 Hours)

Fracture: Basic modes of fracture, Griffith of brittle fracture, Irwin's theory of fracture inelastic-plastic materials. Theories of linear elastic fracture mechanics, stress intensity factors, fracture toughness testing.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Strength and Resistance of Metals - J. M. Lessels, John Wiley and Sons, Inc., 1954.
2. Mechanical Behaviour of Engineering Materials - Joseph Marin, PHI, 1966.
3. Fatigue Testing and Analysis - Y. Lee, J.Pam, R.B. Hathaway & M.E. Barkey Elsevier Press, 2005.
4. Engineering Fracture Mechanics - S. A. Meguid, Elsevier Press, 1989.

REFERENCE BOOKS

1. Mechanical Metallurgy - G. E. Dieter, Mc-Graw Hill Book Co., 1961.
2. Mechanical Behaviour of Materials - N. E. Dowling, PHI, 1997.
3. Introduction to Fracture Mechanics - Kare Hellan, Mc-Graw Hill Book Co., 1985.
4. The Practical Use of Fracture Mechanics - David Broek, MN Publishers, 1982.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	COMPUTER AIDED DESIGN AND MANUFACTURING (CAD/CAM)	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Understand geometric transformation techniques in CAD.
CO2	Develop mathematical models to represent curves and Design surface models for engineering applications.
CO3	Model engineering components using solid modeling techniques and Design and analysis of engineering components.
CO4	Elaborate the use of different manufacturing system in production

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	1		1									
CO2	1	2	2		1									
CO3	1	1	3		2									

CO4	1		2		1									
Avg.	1.0	1.25	2.0		1.25									

SYLLABUS

UNIT – I: (14 Hours)

Basic concepts of CAD, CAD workstation, principles of computer graphics, Advanced modeling techniques, surface modelling, solid modeling, rendering methods. CAD/CAM data base development and data base management systems.

Principles of optimum design, CAD optimization techniques, Application of CAD, computer-aided process planning, post processing, NC code generation, principles of computer aided engineering and concurrent engineering.

UNIT – II: (10 Hours)

Computer aided manufacturing, programming and interface hardware – computer aided, process monitoring - adaptive control, on-line search strategies.

U NIT – III: (13Hours)

Production systems at the operation level, computer generated time standards, machinability data systems, cutting conditions optimization, production planning, capacity planning, shop floor control, computer integrated manufacturing systems, application.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Groover, M. P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 2007.
2. Radhakrishnan, P.,Subramanyan, S., Raju,V., "CAD/CAM/CIM", New Age International Publishers(P) Ltd., 2006.

REFERENCE BOOKS

1. Rao, P.N., "CAD/CAM principles and applications" Tata McGraw Hill, 2002.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	PRODUCTION AUTOMATION AND CNC TECHNOLOGY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Classify and distinguish NC, CNC and DNC systems.
CO2	Develop manual and APT part programs for 2D complex profiles and test the programs through simulation.
CO3	Explain CNC machine structures and system drives.
CO4	Develop interpolation algorithms for control loops and Explain latest developments in CNC system.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1			1									
CO2	1	1	2		3									

CO3	1		2		2									
CO4	1	1	2		2									
Avg.	1.25	0.75	1.5		2.0									

SYLLABUS

UNIT-I: (14 Hours)

Concept and scope of industrial automation – automation strategies , devices, drives and control circuits in automation - Semi-automats, automats and transfer lines.

Concepts, features, fundamentals, advantages and classification of NC systems - input media, Design consideration of NC machine tools - machining centre - MCU functions.

UNIT-II: (12 Hours)

Controls and System devices - Control loops of NC system, CNC concepts, reference pulse and sampled data techniques, microprocessor and CNC adaptive control, ACO and ACC systems.

UNIT – III: (10 Hours)

Computer aided part programming - post processor – APT programming – programming for CNC turning center, Machining center and CNC EDM.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Scrope Kalpakjian,, "Manufacturing processes for Engineering Materials", Addision Wesley, 1997.
2. Radhakrishnan, P., "Computer Numerical Control Machines", New Central Book Agencies, 1997.

REFERENCE BOOKS

1. Yoram Korem., "Computer control of Manufacturing systems", Mc Graw Hill, 1986.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MATERIALS TECHNOLOGY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Classify the materials on basis of their mechanical properties
CO2	Outline different metal working process such as strain hardening, cold working and recrystallization
CO3	Interpret the concept of plastic working and workability metals
CO4	Analyze machinability of carbon steels and nonferrous metals

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	3	1												
CO3	3	2												

CO4	3	2												
Avg.	3.0	1.25												

SYLLABUS

UNIT – I: (12 Hours)

Classification of materials – mechanical properties of metals. Plastic instability – strain hardening / work hardening – strengthening mechanisms – cold working and recrystallization.

UNIT – II: (12 Hours)

Plastic working of metals ,formability of sheet metals, Forming Limit Diagram (FLD) ,super plastic forming.

Workability of bulk metals , workability diagrams , necking and fracture of metals.

UNIT – III: (8 Hours)

Machinability of carbon steels and nonferrous metals – machinability index.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Geller Y.A and Rakhshtadr "Science of Materials", MIR Pub, 1986
2. Narayanasamy R., "Theory of Plasticity", Ahuja publications, 2000.

REFERENCE BOOKS

1. S.Kalpakjian, "Manufacturing Processes for Engineering Materials", Addision Wesley
2. Pub Co, 1997.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MACHINE TOOL TECHNOLOGY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Classify the different columns and beds on basis of their application.
CO2	Outline different types of drives available for speed and feed mechanism
CO3	Design of slideways, spindles and bearings for lathe, drilling, milling machine tools.
CO4	Analyze effect of vibration because of chip, tool geometry, chatter.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													

CO2	3	1												
CO3	2	1	2											
CO4	3	2												
Avg.	3.75	1.0	0.5											

SYLLABUS

UNIT – I: (12 Hours)

Machine tools and their specifications - machine beds and columns – relative merits of different types of beds and columns - design of beds and columns -force on cutting tool, Dynamometers.

UNIT – II: (8 Hours)

Types and design of slideways - wear adjustments.
Design of spindles and bearings – example for lathe, drilling machine and milling machine.
Types of drives for machine tool – step and stepless – speed and feed mechanisms

UNIT – III: (12 Hours)

Machine tool vibration - effect of undeformed chip thickness variations, rake and clearance angle variations - stability of cutting operation - regenerative chatter - testing of machine tools for alignment and.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Sen and Bhattacharya,, "Principles of Machine Tools", New Central Book Agencies, 1975.
2. Boothroyd,G., "Fundamentals of Metal Machining and Machine Tools", Mc Graw hill,1985.

REFERENCE BOOKS

1. Acherkan, "Machine Tool Design", Vol 2 & 3, MIR Pub, 1973.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	COMPUTER INTEGRATED MANUFACTURING	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Understand the effect of manufacturing automation strategies and derive mathematical models for production rate.
CO2	Apply principles of robot programming for executing different function in robotics and PLC programming for networking related problem solving
CO3	Analysing production flow with some manufacturing systems like group technology, cellular manufacturing etc.

CO4	Design a FMS or CIM system for any production system

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1											
CO2	1	1	2		2									
CO3	2	1			1									
CO4	1	1	2		2									
Avg.	1.5	1.25	1.25		1.25									

SYLLABUS

UNIT- I : (10 Hours)

CIM - Evaluation, hardware and software of CIM - Concurrent engineering - Advance Modeling techniques- Numerical control, Computer Numerical Control, Direct Numerical Control, and Adaptive Control

UNIT- II : (12 Hours)

Materials handling and Storage Systems - Types of material handling systems – Storage systems- performance – Automated storage and retrieval systems, carousel storage systems - Interfacing Handling and Storage with Manufacturing. Robotics technology - Control systems - Programming and applications– Automated inspection and testing - Sensor technologies – Coordinate measuring machines – Machine vision.

UNIT- III : (14 Hours)

Cellular manufacturing - Group Technology –- Flexible manufacturing systems: Introduction- configurations-workstations, planning, Applications and benefits – control Systems , Artificial Intelligence and CIM systems.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Mikell P Groover,, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall,2007.
2. Donatas T I junclis, Keith E Mekie, "Manufacturing High Technology Hand Book", Marcel Decker.

REFERENCE BOOKS

1. Paul Ranky, "Computer Integrated Manufacturing", Prentice Hall, 2005.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	PRESS TOOLS IN METAL FORMING	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						
CO1	Classify different elements of press tool operations					
CO2	Illustrate concept of strip layout and calculation of plug point/center of pressure					
CO3	Design the effect of forces and punching pressure during cold and hot working process.					
CO4	Design die for upsetting, bending, forming forging and drawing operations					
CO-PO & PSO Mapping						

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	2	2												
CO3	1	2	2											
CO4	2	1	2											
Avg.	2.0	1.25	1.0											

SYLLABUS

UNIT-I: (10 Hours)

Elements, classification of press tools - clearance between punch and die, shut height and daylight, press tonnage calculation - Strip layout, Basic rules, economic layout, bridge size, calculation of plug point/center of pressure.

UNIT –II: (13 Hours)

Types of Press tools, Types and Role of tooling in the deformation system - Tools for cold extrusion, force analysis, analogue method, nomograms - Tool design - Punch pressure significances -Tolerancing cold extrudes based on VOI data - Design chart for a complete sequence of producing a cold extrude.

UNIT –III: (14 Hours)

Forging Tools - Design of Upsetting tools. Bending and Forming tools, Dies for headers, transfer mechanisms. Design of tool for deep drawing Cutting tools - methods of reducing forces, die pillar set, fine blanking tools.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. Paquin Jr,, "Die Design Fundamentals", New York Industrial Press, 1987.
2. Dallas, B. Daniel,, "Progressive Dies", Michigan-SME, 1994.

REFERENCE BOOKS

1. Smith A David, "Die Design Hand Book", SME, 1990.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MICRO AND NANO MANUFACTURING	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						
CO1	Explain different techniques for the synthesis and characterization of nanomaterials					
CO2	Design and analyze methods and tools for micro and nano manufacturing.					
CO3	Select a micro and nanomanufacturing method and identify key variables to					

	improve quality of MEMS.
CO4	Select appropriate industrially-viable process, equipment and tools for a specific product

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2												
CO2	1	2	1											
CO3	1	2	1											
CO4	2	1												
Avg.	1.5	1.75	0.5											

SYLLABUS

UNIT–I: (10 Hours)

Introduction: Importance of Nano-technology, Emergence of Nanotechnology, Bottom-up and Top-down approaches, challenges in Nanotechnology. Nanomaterials Synthesis and Processing: Methods for creating Nanostructures; Processes for producing ultrafine powders- Mechanical grinding; Wet Chemical Synthesis of nanomaterials- sol-gel process, Liquid solid reactions.

UNIT –II: (12 Hours)

Structural Characterization: X-ray diffraction, Small angle X-ray Scattering, Optical Microscope and their description, Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM), TEM and EDAX analysis, Scanning Tunneling Microscopy (STM), Atomic force Microscopy (AFM).

Spectroscopic characterizations: Basic concepts of spectroscopy, operational principle and application for analysis of nanomaterials, UV-VIS-IR Spectrophotometers, Principle of operation and application for band gap measurement, Raman spectroscopy.

Surface Characterization: X-ray Photoelectron Spectroscopy (XPS), Auger electron spectroscopy, Low Energy Ion Scattering Spectroscopy (LEISS), Secondary Ion Mass Spectroscopy (SIMS), Rutherford Backscattering Spectroscopy (RBS).

UNIT –III: (14 Hours)

Micro-fabrication Techniques: Lithography, Thin Film Deposition and Doping, Etching and Substrate Removal, Substrate Bonding. MEMS Fabrication Techniques, Bulk Micromachining, Surface Micromachining, High- Aspect-Ratio Micromachining.

Nanofabrication Techniques: E-Beam and Nano-Imprint Fabrication, Epitaxy and Strain Engineering, Scanned Probe Techniques, Self-Assembly and Template Manufacturing.

MEMS devices and applications: Pressure sensor, Inertial sensor, Optical MEMS and RF-MEMS, Micro-actuators for dual-stage servo systems.
Teaching Methods: Chalk& Board
TEXT BOOKS 1. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005. 2. Gabor L. Hornyak, H.F Tibbals, Joydeep Dutta & John J Moore, Introduction to Nanoscience and Nanotechnology, CRC Press, 2009. 3. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.
REFERENCE BOOKS 1. Robert F Speyer, Thermal Analysis of Materials, Marcel Dekker Inc , New York, 1994. 2. B.D. Cullity - Elements of X-Ray Diffraction, 3rd edition, Prentice Hall, 2002. 3. Tai-Ran Hsu, "MEMS and Microsystems: Design and Manufacture," McGraw- Hill, 2008

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	ADVANCE MANUFACTURING LABORATORY	**0**	**0**	**4**	**2**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Prepare a gear and measurement of Cutting Force and Temperature in Turning
CO2	Evaluate the effect of process parameters during EDM and ECM
CO3	Understanding CNC modeling and programming
CO4	Study of welding technology and quality test

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			2										
CO2	1	2		2										
CO3	1			1	2									
CO4	2			2										
Avg.	1.0	0.5		1.75	0.5									

SYLLABUS

LIST OF EXPERIMENTS : (Minimum six experiment)

1. Gear Manufacturing by universal milling machine
2. Measurement of Cutting Force and Temperature in Turning
3. CNC modelling and programming
4. Studies on GTAW, GMAW processes
5. Weld quality tests
6. Electro-Discharge Machining
7. Electro Chemical Machining
8. CAD software introduction with simple examples. Single object modelling.
9. Plane strain compression test for sheet type of specimen to obtain stress-strain behavior

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP

	METALLURGY AND NON-DESTRUCTIVE TESTING LABORATORY	**0**	**0**	**4**	**2**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Specimen preparation & Micro structural examination of ferrous alloys
CO2	Understand the Direct Tension Test, Compression Test, Hardness Test and Impact Test
CO3	Experimentation on Fluorescent particle inspection test and Liquid penetrant test
CO4	Experimentation on Eddy Current Testing and Ultrasonic flaw detection

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2			2										
CO2	2	1		2										
CO3	2			2										
CO4	2			2										
Avg.	2.0	0.25		2.0										

SYLLABUS

LIST OF EXPERIMENTS: (Minimum six experiment)

1. Specimen preparation & Micro structural examination of ferrous alloys
2. Direct Tension Test
3. Compression Test
4. Hardness Test : Brinell's Hardness Test , Rockwell Hardness Test
5. Impact Test
6. Liquid penetrant test
7. Fluorescent particle inspection test.
8. Ultrasonic flaw detection.
9. Eddy Current Testing.

II SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC		Metal Cutting – Theory and Practice	3			3
2	PC		Advanced Manufacturing Processes	3			3
3	PE-3		Rapid Manufacturing Processes	3			3
			Manufacturing Management				
			Welding Application Technology				
			Material selection and safety				
4	PE-4		Finite Element Method	3			3
			Manufacturing of products from nonmetallic materials				
			Precision Engineering				
			High Speed Machining				
5	PC		Metal Cutting Lab			4	2
6	PC		Advance welding Lab			4	2
7	Audit		Audit course-II	2			0
8	PC		Mini-project			4	2
TOTAL				**12**	**2**	**8**	**18**

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	METAL CUTTING – THEORY AND PRACTICE	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Explain the ASA, ORS and NRS systems of tool geometry and derive their interrelationships.
CO2	Develop the relations for chip reduction coefficient, shear angle, shear strain, forces, power, specific energy and temperatures associated with orthogonal cutting.
CO3	Develop shear angle relationships for natural and controlled contact cutting and stress-strain relations in orthogonal cutting.
CO4	Select cutting fluids, cutting tool materials and tool geometry for improving machinability and tool life.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	2	2	1											
CO3	2	2	1											
CO4	2	2												
Avg.	2.25	2.0	0.5											

SYLLABUS

UNIT- I: (14 Hours)

Geometry of Cutting Tools: Geometry of single-point cutting tool: Orthogonal Rake System (ORS), Conversions between ASA and ORS systems – Graphical and Analytical Methods, Normal Rake System (NRS) & relation with ORS.

Mechanics of Machining Processes: Orthogonal and Oblique cutting, Mechanics of Chip formation: Types of chips, chip-breakers, Chip reduction coefficient, shear angle, shear strain, Built- Up-Edge and its effect in metal cutting, Merchant's analysis of metal cutting process - Various forces, power and specific energy in cutting, Problems on Tool Geometry and Mechanics of Machining.

UNIT- II :(12 Hours)

Tool wear, Tool life, Machinabilty and Machining Economics: Wear Mechanisms, Types of tool wear, Tool Life and Machinability, A brief treatment for single pass turning operations, Problems on Economics of Machining. Cutting Tool Materials: Desirable Properties of tool materials, Characteristics of Cutting Tool Materials, Indexable inserts, Coated tools.
UNIT- III : (12 Hours) Mechanics of Multipoint Machining processes: Drill Geometry & Mechanics of Drilling Process, Geometry of Milling Cutters and Mechanics of Milling process, Mechanics of Grinding (plunge grinding and surface grinding), Grinding wheel wear.
Teaching Methods: Chalk& Board
TEXT BOOKS 1. M. C. Shaw, Metal cutting-Principles and Practices, Cambridge University press. 2005 2. Rao PN, Manufacturing Technology–Metal Cutting and Machine Tools, 3/e, TMH, New Delhi, 2013. 3. Bhattacharya A, Metal Cutting: Theory and Practice, New Central Book Agency, Kolkata, 2007
REFERENCE BOOKS 1. Winston A. Knight and Geoffrey Boothroyd, Fundamentals of Machining and Machine Tools, 3/e, Taylor & Francis Group, 2005. 2. Trent, E. M. and P. K. Wright, Metal Cutting, 4th edition., Butterworth-Heinemann, 2000

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	ADVANCED MANUFACTURING PROCESSES	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Understand the manufacturing processes including stir casting, tape casting-process and high energy rate forming.
CO2	Explain the working principle of Electron beam, laser beam and laser hybrid welding processes and suggest their applications.
CO3	Apply advanced casting methods including V-process, lost foam process and Magnetic molding process for ceramics and composite materials.
CO4	Apply friction and friction stir welding processes to weld difficult-to-weld materials.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1												
CO2	3	2												
CO3	3	2											2	
CO4	3	1												
Avg.	3.0	1.5											0.5	

SYLLABUS

UNIT- I :(10 Hours)

Advances in casting processes: Introduction to solid state welding processes, Advantages and applications and imitations, Classification of solid state welding processes and describe each processes , Adhesive bonding , advantages and applications.

Advances in casting: Stir casting process, variables in stir casting process, advantages and application. High pressure molding, metal injection molding, centrifugal casting Die casting process.

UNIT- II :(14 Hours)

Advances in welding: Introduction friction welding processes, advantages ,limitations and applications, processes parameters, Friction welding of similar and dissimilar metals, Friction stir welding process, parameters, tool geometry, applications, friction stir processing, Friction stir welding similar and dissimilar materials, Electron beam welding process Laser beam welding processes, Hybrid welding process, advantages and limitations Defective analysis of friction welded components.

UNIT- III :(13 Hours)

Advances in forming: Introduction forming processes, advantages ,limitations and applications, Vacuum forming and hydro forming , advantages and applications, High velocity forming, advantages and applications, Electromagnetic forming, advantages and applications Design consideration in forming: case studies, Design consideration in casting and welding : case studies, Laser Beam welding process parameters, atmospheric affect. Laser Beam welding of steels, Defective analysis of Laser beam welds.

Teaching Methods: Chalk& Board

TEXT BOOKS

1. R. S. Mishra, Friction Stir Welding and Processing, ASM International, 2007.
2. Heine, Loper and Rosenthal, "Principles of Metal Casting", Tata McGraw-Hill, New Delhi, 2008.

REFERENCE BOOKS

1. R. Venketa Rao, "Advanced Modeling and Optimization of Manufacturing Processes", Springer, 2013.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	RAPID MANUFACTURING PROCESSES	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Model complex engineering products and develop process plans for rapid production
CO2	Analyze and select a rapid manufacturing technology for a given component
CO3	Identify the errors during generation of STL files and minimize them.
CO4	Optimize FDM process parameters to improve the quality of the parts.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		1		1									
CO2	2	1	1		1									
CO3	2	1			2									
CO4	2		2		1									
Avg.	2.0	0.5	1.0		1.25									

SYLLABUS

UNIT- II: Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Classification of RP. RP Software: software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC,IGES & STEP. Photopolymerization RP Processes: Stereo-lithography (SL), SL resin curing process, SL scan

patterns, Micro-stereo-lithography, Applications of Photopolymerization Processes.
UNIT- II :(13 Hours) Powder Bed Fusion RP Processes: Selective laser Sintering (SLS), Powder fusion mechanism and powder handling, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Applications of Powder Bed Fusion Processes. Extrusion-Based RP Systems: Fused Deposition Modelling (FDM), Principles, Plotting and path control, Applications of Extrusion-Based Processes. Printing RP Processes: 3D printing (3DP), Technical challenges in printing, Printing process modelling, Applications of Printing Processes
UNIT- III :(12 Hours) Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods. Reverse Engineering: Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development. Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc. RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.
Teaching Methods: Chalk& Board
TEXT BOOKS 1. Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010. 2.Ian Gibson., David W Rosen., Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010
REFERENCE BOOKS 1. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MANUFACTURING MANAGEMENT	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Identify key decision areas for operations managers and researchers for design of production planning and control systems.
CO2	Evaluate and interpret Demand Forecast for production planning.
CO3	Design an optimal facility layout and select appropriate product design approach.
CO4	Apply ROP, MRP and JIT systems for inventory control in production systems

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2										2			
CO2	2	2												
CO3	2		2											
CO4	3	1									1			
Avg.	2.25	0.75	0.5								0.75			

SYLLABUS

UNIT- I :(12 Hours)

Competitive priorities and manufacturing strategy: Introduction, Historical perspective of

manufacturing management, Competitive priorities and operational strategy, Functional area strategy and Capability, Case Study. Demand Forecasting: Introduction, Quantitative Methods introduction, Time series and moving averages method, Exponential Smoothing method, Regression Analysis Method, Qualitative Methods.
UNIT- II :(10 Hours) Facility Design: Introduction and History, Product design and process selection, Capacity planning, Plant location and Plant layout. Inventory control: From EOQ to ROP, Independent Demand Inventory control & Economic Order Quantity (EOQ), Dynamic lot sizing, Statistical inventory control models
UNIT- III :(12 Hours) MRP crusade: History, Need, Evolution, Dependent Demand & Material Requirement Planning (MRP), Structure of MRP system, MRP Calculations. Production Planning and Control: Shop floor control, Production scheduling, Aggregate planning, The JIT revolution: Just-in-Time System: origin & goals, Characteristics of JIT Systems, Continuous Improvement, The Kanban System, Strategic Implications of JIT System.
Teaching Methods: Chalk& Board
TEXTBOOKS: 1. Krajewski U and Ritzman LP, Operations Management: Strategy and Analysis, Pearson Education Pvt Ltd., Singapore, 2002. 2. R. Panneerselvam, Production and Operation Management, third edition, PHI publication.
REFERENCE BOOKS 1. Chase RB, Aquilano NJ and Jacobs RF, Operations Management for Competitive Advantage, McGraw-Hill Book Company, NY, 2001

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	WELDING APPLICATION TECHNOLOGY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Understand the fundamental principle of gas and arc welding processes
CO2	Illustrate the resistance welding processes
CO3	Discuss the method involved in solid state welding processes
CO4	Design of weld joints, weldability and testing of weldments

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2												
CO2	2	2												
CO3	3	1												
CO4	2	1	2											
Avg.	2.5	1.5	0.5											

SYLLABUS

UNIT- I :(12 Hours)

GAS AND ARC WELDING PROCESSES

Fundamental principles –Oxyacetylene welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes – advantages, limitations and applications. RESISTANCE WELDING PROCESSES Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes – advantages, limitations and applications.
UNIT-II :(12 Hours) SOLID STATE WELDING PROCESSES Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes – advantages, limitations and applications. Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace.
UNIT-III :(12 Hours) DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS Various weld joint designs – Weldability of Aluminium, Copper, Stainless steels. Destructive and non destructive testing of weldments
Teaching Methods: Chalk& Board
TEXT BOOKS: 1. Parmer R.S., "Welding Engineering and Technology", 1st edition, Khanna Publishers, New Delhi, 2008. 2. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992.
REFERENCE BOOKS 1. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MATERIAL SELECTION AND SAFETY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Classify Engineering material on the basis of physical properties
CO2	Define the materials for corrosion and wear resistance
CO3	Illustrate theories of failure, Rankine's formula, Johnson formula, Reduction of stress concentration
CO4	Selecting materials for automotive components

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1												
CO2	2			3									1	
CO3	2	2		3										

CO4	3	1	1											3
Avg.	2.5	1.0	0.25	1.5									0.25	0.75

SYLLABUS

UNIT- I : (14 Hours)

INTRODUCTION:

Classification of design, Engineering materials and their physical properties applied to design, Selection of material, Factors of safety in design, Endurance limit of material - Determination of endurance limit for ductile material, Notch sensitivity, Principles of design optimization, Theories of failure , Rankine's formula, Johnson formula, Reduction of stress concentration. Technologically important properties of materials, Physical, Chemical and Mechanical properties of metals, Criteria of selection of materials like properties, cost, manufacturing process, availability, legal and safety factors.

UNIT-II : (8 Hours)

MATERIALS FOR CORROSION AND WEAR RESISTANCE Materials for atmospheric, soil, water, acid and alkaline resistance, Corrosion prevention coatings, material for Chemical and Petroleum industries, materials and coatings for wear resistance.

UNIT- III : (12 Hours)

MATERIALS FOR A UTOMOTIVE APPLICATIONS

Criteria of selecting materials for automotive components viz cylinder block, Cylinder head, piston, piston ring, Gudgeon pin, connecting rod, crank shaft, crank case, cam, cam shaft, engine valve, gear wheel, clutch plate, axle, bearings, chassis, spring, body panel - radiator, brake lining etc. Application of nonmetallic materials like ceramics MMCs for engine components, Polymers and FRPs for exterior and interior.

Teaching Methods: Chalk& Board

TEXT BOOKS:

1. Gladius Lewis, "Selection of Engineering Materials", Prentice Hall Inc. New Jersey, USA, 1995.
2. Charles J A and Crane. F A.A., "Selection and Use of Engineering Materials",3rd Edition,
3. Butterworths, London UK, 1996.

REFERENCE BOOKS

1. George Murray "Hand book of material selection for engineering application", Taylor & Francis.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	FINITE ELEMENT METHOD	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						
CO1	Understand the Finite Element Formulation procedure for structural Problems.					
CO2	Understand the representation and assembly considerations for Beam and Frame elements.					
CO3	Analyze Plane stress, Plane strain, axi-symmetric Problems.					
CO4	Formulate and solve simple heat transfer and fluid mechanics problems and Identify significant applications of FEM in Manufacturing.					
CO-PO & PSO Mapping						

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	1											
CO2	3	2	1											
CO3	3	3	2											
CO4	2	2	3											
Avg.	2.5	2.5	1.75											

SYLLABUS

UNIT-I : (13 Hours)

Introduction: Role of the Computer, General Steps of the Finite Element Method, Applications of the Finite Element Method, Advantages of the Finite Element Method.

Stiffness Matrix, Derivation of the Stiffness Matrix for a Spring Element, Boundary Conditions, Potential Energy Approach.

Derivation of the Stiffness Matrix for a Bar Element, Displacements, Transformation of Vectors in Two Dimensions, Global Stiffness Matrix.

Energy Approach to Derive Bar Element Equations: Potential Energy Approach to Derive Bar Element Equations, Comparison of Finite Element Solution to Exact Solution for Bar, Galerkin's Residual Method and Its Use to Derive the One-Dimensional Bar Element Equations, Other Residual Methods and Their Application to a One-Dimensional.

UNIT-II : (12 Hours)

Development of the Plane Stress and Plane Strain Stiffness Equations: Basic Concepts of Plane Stress and Plane Strain, Derivation of the Constant-Strain Triangular Element Stiffness Matrix and Equations, Treatment of Body and Surface Forces.

Development of the Linear-Strain Triangle Equations: Derivation of the Linear-Strain Triangular Element Stiffness Matrix and Equations.

Axisymmetric Elements: Derivation of the Stiffness Matrix, Solution of an Axisymmetric Pressure Vessel, Applications of Axisymmetric Elements

UNIT-III : (13 Hours)

Isoparametric Formulation: Isoperimetric Formulation of the Bar Element Stiffness Matrix, Gaussian and Newton-Cotes Quadrature (Numerical Integration), Evaluation of the Stiffness Matrix and Stress Matrix by Gaussian Quadrature.

Three-Dimensional Stress Analysis: Three-Dimensional Stress and Strain, Tetrahedral Element.

Plate Bending Element: Basic Concepts of Plate Bending, Derivation of a Plate Bending Element Stiffness Matrix and Equations.

Teaching Methods: Chalk& Board
TEXT BOOKS: 1. Finite Element Methods – J. N. Reddy. Tata Mc GrawHill.2000 2. Finite Element Analysis – T. Chandrupatla, University Press.1998 3. Finite Element Method: Its Basis and Fundamentals. O. C. Zienkiewicz, R. L. Taylor and J. Z. Zhu. Elseiver, 2005.
REFERENCE BOOKS 1. Introduction to the Finite Element Method – C. S. Desai and J. F. Abel. East West Pvt. Ltd., 1972 2. The Finite Element Method in Engineering –S.S.Rao.Butterworth-Heinemann, 1999.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MANUFACTURING OF PRODUCTS FROM NON METALIC MATERIALS	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						
CO1	Understand the molding and machining of polymers					
CO2	Illustrate the techniques involved in rubber manufacturing and processing					
CO3	Evaluate the procedure for processing and manufacturing of glass and other					

	ceramics material.
CO4	Define the manufacturing Techniques and applications of different Composites namely PMC, MMC and CMC

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1										2	
CO2	3	1	1											
CO3	3	1	1											
CO4	3	2	1										3	
Avg.	3	1.5	1										1.25	

SYLLABUS

UNIT-I : (13 Hours)

Polymers - molding of thermoplastics - plastic sheet forming process - machining of thermoplastics - Thermosetting plastics - properties, molding processes and machining - other processing methods for plastics - plastic component design.

Rubber: Manufacturing process - Manufacturing techniques, materials design, sizing, components, building, moulding and vulcanising of tyres - Belting – manufacture and types of hose.

UNIT-II : (10 Hours)

Types, processing and manufacturing techniques of Glass vessels. Ceramic materials - Processing of ceramic products.

UNIT-III : (10 Hours)

Composite matearials, Fiber, particulate, whisker reinforced ceramics, properties of reinforcements and matrix. Manufacturing Techniques and applications of different Composites namely PMC, MMC and CMC.

Teaching Methods: Chalk& Board

TEXT BOOKS:

1. Blow C M,, "Rubber Technology and Manufacturing", Newman Butterworths, 1977.
2. Hasle Hurst, "Manufacturing Technology", ELBS, 1973.

REFERENCE BOOKS

1. Vanviack L.H, "Physical Ceramics for Engineers", Addision Wesley Publicxation, 1964.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP

	PRECISION ENGINEERING	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Apply fits and tolerances for parts and assemblies according to ISO standards.
CO2	Apply selective assembly concept for quality and economic production.
CO3	Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
CO4	Evaluate the part and machine tool accuracies.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2											
CO2	2	3	1											
CO3	3	2	1											
CO4	2	3	2											
Avg.	2.5	2.75	1.5											

SYLLABUS

UNIT-I : (12 Hours)

Tolerance and fits: ISO and ISI designation, calculation of clearance and interference fits, probability of clearance and interference fits in transitional fits, examples of applications of various fits, concept of selective assembly, calculation of fits in selective assembly.

Concept of part and machine tool accuracy: Accuracy specification of parts and assemblies, accuracy of machine tools, alignment testing of machine tools.

UNIT-II : (12 Hours)

Theory of dimensional chains: Definitions, concept of dimensional chain or tolerance stack, Examples of right and wrong dimensioning. Basic theory of dimensional chains. Calculation of tolerances in dimensional chains.

Errors during machining: Errors due to compliance of machine-fixture-tool-work piece (MFTW) System, influence of compliance on progressive decrease of error in a series of machining operations, theory of location, location errors, errors due to geometric Inaccuracy of machine tool, errors due to tool wear, errors due to thermal effects, errors due to clamping. Statistical method of accuracy analysis.

UNIT-III : (12 Hours)

surface roughness: Definition and measurement, surface roughness indicators, (CLA, RMS,

etc,.) and their comparison, influence of machining conditions, methods of obtaining high quality surfaces, Lapping, Honing, Super finishing and Burnishing processes. Calculation of machining allowance: In process dimensioning of work pieces with examples Manufacturing methods of typical machine tool components: Spindles, gears, and beds.
Teaching Methods: Chalk& Board
TEXT BOOKS: 1. R.L.Murty, "Precision Engineering in Manufacturing", New Age International Publishers, 1996. 2. V.Kovan, "Fundamentals of Process Engineering", Foreign Languages Publishing House, Moscow, 1975
REFERENCE BOOKS 1. J.L.Gadjala, "Dimensional control in Precision Manufacturing", McGraw Hill Publishers.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	HIGH SPEED MACHINING	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Articulate the differences between conventional machining and high speed machining
CO2	Scrutinize the determinants of high speed machining and improve its performance.
CO3	Outline the requirements on machine tool technology to support High Speed Machining.
CO4	Identify and select the best cutting tool materials for high speed machining and Summarize the problems associated with dry and near dry machining

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1											
CO2	3	2		3										
CO3	3	1		1										
CO4	3	1		3										
Avg.	3	1.25	0.25	1.75										

SYLLABUS

UNIT-I (12 HOURS)

Introduction: Advanced Machining Processes, A new Era The Determinants of High-Speed Machining: Weight, Materials, Machine Tools, Simple Processes and Systems, Fast Machining, Response Time, and Throughput, Smart Machines, Tools, and Processes.

UNIT-II : (13 Hours)

Characteristics of High-Speed Machining: Machining Parameters. Machine-tool Technology: Manufacturing and Multi-task Machining Systems, High-Speed Machining, Support Technology.

Advanced Cutting Tools: Cutting-Tool Materials, Cutting-Tool Design, Tool Guidance and Stability, Chip Control, Burr Control, Stringent Finish Requirements, Cost and Quality, Intelligent Tooling. Precision Hard Machining , Advanced Milling Operations.
UNIT-III : (12 Hours) Precision Tooling Interface: Connection and Interface, Tool Clamping, Balancing, Run-out. Dry and Near-dry Machining: Environmental Impact, Dry Machining, Near-dry Machining, Reducing Coolant Use.
Teaching Methods: Chalk& Board
TEXT BOOKS: 1. Bert P. Erdel, High Speed Machining, SME Publications, Michigan, 2003. 2. Dale Mickelson, Hard Milling and High Speed Machining, Industrial Press Inc, United States, 2007 .
REFERENCE BOOKS 1. King, Robert "Handbook of high-speed machining technology", Springer,1985.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	METAL CUTTING LABORATORY	**0**	**0**	**4**	**2**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Preparation of a single point cutting tool and Manufacture of spur and helical gears.
CO2	Effect of process parameters on surface finish and forces in surface grinding operation.
CO3	Estimation of chip reduction coefficient and shear angle in orthogonal turning
CO4	Evaluation of the effect of process parameters on surface roughness in turning

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	3											
CO2	2	3	1	2										
CO3	3	3	1	3										
CO4	3	3	1	2										
Avg.	2.75	2.5	1.5	1.75										

SYLLABUS

LIST OF EXPERIMENTS: (Minimum six experiment)

1. Turning, taper turning, chamfering, knurling, thread cutting and eccentric turning

on lathe.

2. Conversion of a cylindrical shaft to a square shaft by shaping process.
3. Manufacture of spur and helical gears on a milling machine.
4. Estimation of chip reduction coefficient and shear angle in orthogonal turning.
5. Preparation of a single point cutting tool with a given tool geometry.
6. Measurement of cutting forces and average cutting temperature in turning process.
7. Estimation of tool life of a single point turning tool.
8. Evaluation of the effect of process parameters on surface roughness in turning.
9. Effect of process parameters on surface finish and forces in surface grinding operation.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	ADVANCE WELDING LABORATORY	**0**	**0**	**4**	**2**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Effect of various welding parameters on bead characteristics of MIG/TIG welding.
CO2	Analysis of distortion in welding based on residual stresses.
CO3	Study the Weldability analysis of cast iron, low carbon steels and stainless steels.
CO4	Preparation of a cup using Resistance spot welding and Preparation of T- joint using TIG welding.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	2										
CO2	3	2		3										
CO3	3	1												
CO4	3	2	3											

Avg.	3	1.75	0.6	1.25										

SYLLABUS

LIST OF EXPERIMENTS: (Minimum six experiment)

1. Effect of various welding parameters on bead characteristics in MMAW.
2. Effect of various welding parameters on bead characteristics of MIG/TIG welding
3. Preparation of a cup using Resistance spot welding
4. Preparation of T- joint using TIG welding
5. Weldability analysis of cast iron
6. Weldability analysis of plain carbon and low carbon steels
7. Weldability analysis of stainless steels
8. Selection of welding parameters based on heat flow analysis
9. Analysis of distortion in welding based on residual stresses.

III SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	OE		Industrial Safety	3	0	0	3
			Human Resource Management				
			Project Management And Costing				
			Optimization Techniques				
2	PE		Flexible Manufacturing Systems	3	0	0	3

			Robotics				
			Mechanical Drives				
			Theory of Plasticity				
PRACTICAL / SESSIONAL							
3	ES		Dissertation Phase-I	0	0	20	10
TOTAL				6	0	20	16

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	INDUSTRIAL SAFETY	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						
CO1	Define Industrial safety: Accident, causes, types, results and control					
CO2	Understand the fundamentals of maintenance engineering					
CO3	Analyze wear and corrosion and their prevention: Wear- types, causes, effects, wear reduction methods					
CO4	Apply the principle and factors affecting the corrosion with application lubrication					

CO-PO & PSO Mapping														
COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2											
CO2	3	1	1											
CO3	2	2	1											
CO4	2	2	1											
Avg.	2.5	2	1.25											

SYLLABUS

UNIT-I (12 Hours)

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II (12 Hours)

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relationwith replacement economy, Service life of equipment.

UNIT-III (12 Hours)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and

applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Teaching Methods: Chalk& Board

Text Book:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.1998
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.2000

Reference Book:

1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	HUMAN RESOURCE MANAGEMENT	**3**	**0**	**0**	**3**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						

CO1	To discuss strategically plan for the human resources needed to meet organizational goals and objectives.
CO2	To define the process of job analysis and discuss its importance as a foundation for human resource management practice
CO3	To evaluate and critique an organization's selection process
CO4	To explain and apply the legal principles that apply to a wide range of workplace issues

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2	1	3												
CO3	1	1	2	3										
CO4	2	2												
Avg.	1.75	1.5	0.5	0.75										

SYLLABUS

UNIT-I : (12 Hours)

Human Resource Development Strategies, Design And Experience, Human Resource Development: HRD-An Overview, Line Managers and HRD, Task Analysis, Motivational Aspects of HRD, Developmental Supervision, Counselling and Mentoring , HRD for Health and Family Welfare in Select HRD Culture and Climate, HRD for Workers, HRD/OD Approach to IR Corporate Business.

UNIT-II : (12 Hours)

Basics of Human Resource Planning , Macro Level Scenario of Human Resource Planning, Concepts and Process of Human Resource Planning, Methods and Techniques-Demand Forecasting, Methods and Techniques-Supply Forecasting, Job Evaluation: Concepts, Scope and Limitations, Selection and Recruitment, Induction and Placement, Performance and Potential Appraisal, Transfer, Promotion and Reward Policies, Training and Retraining.

UNIT- III : (12 Hours)

Wage and Salary Administration & Labour Legislation, Wage Concepts and Definition of Wages Under Various Labour Legislation, Norms for Wage Determination, Law relating to Payment of Wages and Bonus, Pay Packet Composition, Design of Performance-linked Reward System, Philosophy of Labour Laws, Labour Laws, Industrial Relations and Human Resource Management, Indian Constitution and Labour Legislations, Time Management:

Importance of Time factor, Time waster, Prioritizing Work Scheduling, Functions of the Time Office, Flexible Work arrangements.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Beardwell and Len Holder, Human Resource Management Macmillan India Ltd., 1999 2. Graham H.T., & R.Bennet, Human Resource Management – Pitman, London2001
REFERENCE BOOKS 1. Performance Appraisal, Theory and Practice – AIMA VIKAS Management Series, 2000 2. C.B. Manmoria, Personnel Management – Himalayan Publishing Co., New Delhi.1998 3. Nair,N.G. & Latha Nair:Personnel Management & Industrial Relations–S.Chand & Co.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	PROJECT MANAGEMENT AND COSTING	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Gain the knowledge and confidence to manage a project from beginning to end
CO2	Identify the different stages involved in project planning
CO3	To understand the concept of Project Scheduling and to analysis the Project Feasibility
CO4	To understand the concept of Break even analysis and overhead allocation Techniques.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1									2			
CO2	2	3												
CO3	3	3									1			
CO4	3	2									1			
Avg.	2.75	2.25									1.0			

SYLLABUS

UNIT – I : (10 Hours)

Project Feasibility Analysis: Technical feasibility, commercial and financial viability, Environment Analysis.

Project Engineering: Project Management Techniques : PERT, CPM, Project Scheduling Crashing, PERT / COST, LOB.

UNIT – II: (14 Hours)

Projects Financing alternatives, Sources of finance, their advantages, Choice of Financing mix, Capital budgeting.

Costing: Fixed and variable cost. Break even analysis, Overhead allocation Techniques.

UNIT – 3: (16 Hours)

Project Organisation, management and control: Project organization and control staffing, monitoring: cost, time and control and progress monitoring techniques.

Product and service pricing: Availability and quality-based pricing for services.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Prasanna Chandra: Project Engineering and Management, Prentice Hall
REFERENCE BOOKS 1. Levy and Weist: Management guide to PERT / CPM, Prentice Hall

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	OPTIMIZATION TECHNIQUES	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Differentiate and classify traditional and non-traditional optimization methods.
CO2	Formulate an optimization problem to solve complex manufacturing engineering problems.
CO3	Apply A*, AO*, Branch and Bound search techniques for problem solving.
CO4	Apply GA, PSO and ACO algorithms for problems in scheduling, process planning and layout design.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												
CO2	2	3												
CO3	1	3												
CO4	1	3										2		
Avg.	1.5	3										0.5		

SYLLABUS

UNIT- I : (12 Hours)

Anova & design of experiments: Analysis of Variance and its meaning- one-way classification- two-way classification. Basic principles of design of experiments (replication, randomization and local control) - CRD- RBD- LSD.

UNIT – II: (12 Hours)

Factorial experiments & ta guchi approach : Factorial experiments and their need- and Factorial Experimental Designs without confounding (Theory and Problem only, no derivation expected). Taguchi Approach: Parameter Design, Robust Design

UNIT- III : (14 Hours)

Optimization technique by search method : Optimal problem formulation -Boundary phase method – Fibonacci search method – Golden section search method – Powell"s conjugate direction method – Conjugate gradient method – Variable-metric method.

Genetic algorithms(GAs) - working principle – difference between GAs and the traditional

methods – Gas for constrained optimization – Simulated annealing – Global optimization: using steepest descent method and GA.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Rao, S.S.: Optimization theory and applications, Wiley Eastern, 1984. 2. Montgomery, D. C.: Design and Analysis of Experiments, John Wiley & Sons, 1984. 3. REFERENCE BOOKS 1. Cochran, W.G. and Cox, G.M.: Experimental Designs, 2nd Edition, John Wiley & Sons, Inc, 1957. 2. Davis, L.: Handbook of genetic algorithms, Van Nostrand Reinhold, 1991. 3. Deb, K.: Optimization for engineering design, Prentice Hall of India, 2005. 4. Phadke, M. S: Quality Engineering using robust design, Prentice Hall, 1989. 5. Philip, R. J.: Taguchi Techniques for quality engineering, McGraw Hill, 1989.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	FLEXIBLE MANUFACTURING SYSTEMS	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems
CO2	Explain processing stations and material handling systems used in FMS environments
CO3	Design and analyze FMS using simulation and analytical techniques and Describe tool management in FMS
CO4	Analyze the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1								1		
CO2	2	1	1	1								1		
CO3	2	1	1											
CO4	2	1	1											
Avg.	2	1	1	0.5								0.5		

SYLLABUS

UNIT- I : (10 Hours)

Understanding of FMS:Evolution of Manufacturing Systems, FMS: Definition, objective and Need, FMS: components, Merits, Demerits and Applications, Flexibility in Pull and Push type. Classification of FMS Layout: FMS: Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type .

UNIT- II : (12 Hours)

Salient features of processing stations: Processing stations- Machining Centers, Turning centre, Coordinate measuring machine (CMM), Washing/ Deburring station.

MHS; An introduction: Material Handling System Conveyor, Robots, Automated Guided

Vehicle (AGV), Automated Storage Retrieval System (ASRS).
UNIT-III : (14 Hours) Management Technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, FMS: Configuration planning and routing, FMS: Production Planning and Control, FMS: Scheduling and loading. Design of FMS: FMS: Performance Evaluation introduction, Analytical model of FMS, Simulation model of FMS. Case studies: Typical examples /case studies of FMS.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Groover,M.P "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India Pvt.Ltd. New Delhi 2009 2. Reza A Maleki "Flexible Manufacturing system" Prentice Hall of Inc New Jersey, 1991
REFERENCE BOOKS 1. William W Luggen, "Flexible Manufacturing Cells and System" Prentice Hall of Inc New Jersey, 1991. 2. John E Lenz "Flexible Manufacturing" marcel Dekker Inc New York, 1989.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	ROBOTICS	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Model, analyze and control engineering systems.
CO2	Select appropriate sensors, transducers and actuators to monitor and control the behavior of a process or product
CO3	Develop PLC programs for a given task.
CO4	Understand the evolution, classification, structures and drives for robots.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	2											
CO2	1	2												
CO3	1	2	2											
CO4	3	1												
Avg.	1.5	1.75	1											

SYLLABUS

UNIT - I (10 Hours)

Fundamentals of Robotics: Introduction Automation & Robotics robot applications robotic systems, robot anatomy and robot configurations, Joint types used in robots, robot wrists, joint notation schemes, work value for various robot anatomies, robot specifications, introduction to robot arm dynamics.

Robots end-effectors-classification of end-effectors, mechanical grippers, hooking or lifting grippers, grippers for molten metal's, plastics, vacuum cups, magnetic grippers, electrostatic grippers, multiple grippers, internal & external grippers, drive systems for

gripers, active & passive grippers.
UNIT – II: (12 Hours) Robot Kinematics - Forward & reverse kinematics, forward and reverse transformation of two DOF & three DOF 2-D manipulator, homogeneous transformations. Robot drives & control-pneumatic power drives, hydraulic systems, electric drives, robot controllers-servo and non servo systems, motion control of robots, point to point and continuous path control, robot programming methods. Basic control system models, joint-interpolated motion and straight line motion. Robot Sensors: Scheme of robotic sensors, contact type sensors, force, torque, touch, position, velocity sensors, non-contact type sensors, electro-optical imaging sensors, proximity sensors, range imaging sensors, robot environment and robot input/output interfaces, machine intelligence, safety measures in robots. UNIT – 3: (14 Hours) Robot cell layouts, multiple robots and machine interface, other considerations in work cell design, work cell control, interlocks, error detection and recovery, work cell controller, robot cycle time analysis. Quantitative Techniques for economic performance of robots: Robot investment coats, robot operating expenses. General considerations in robot material handling, pick and place operations, machine loading and unloading.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Robotics Technology & Flexible Automation, S. R. Deb, Tata McGraw Hill. 2. Industrial Robotics, M. P. Groover, McGraw Hill. 3. Robotics for Engineers, Y. Koren, McGraw Hill.
REFERENCE BOOKS 1. Robots & Manufacturing Automation by Asfahal C. Ray, John Wiley. 2. Robotic Engineering, Richard D. Klafter, PHI. 3. Robots & Control, Mittal & Nagrath, Tata McGraw Hill.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	MECHANICAL DRIVES	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Design of Keys, Shaft and Couplings.
CO2	Design and analysis of Flywheel
CO3	Design and analysis of clutch such as friction, cone, centrifugal clutch
CO4	Design and analysis of different Gears such as spur, helical, bevel gears

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	3											
CO2	1	2	3											
CO3	1	2	3											
CO4	1	2	3											
Avg.	1	1.75	3											

SYLLABUS

UNIT – I: (12 Hours)

Design of Keys, Shaft and Couplings: Classification of keys and pins, Design of keys and pins, Theories of failure, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASME code for shaft design.

Design of Coupling: Types of shaft coupling, design of flange coupling . Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking of spring, spring surge, end condition of springs.
UNIT- II : (14 Hours) Design of Flywheel: Functions, Coefficient of fluctuation of energy and Coefficient of fluctuation of speed, energy storage in flywheel, stresses in flywheel, design of flywheel. Design of clutch: Friction clutch, Cone clutch and Centrifugal clutch, Design of Brake : Block & Band brake, Internal expanding shoe brake. Design of Gears: Review of kinematics of gears & terminology, interference, tooth profiles, formative number of teeth etc. Design of Spur Gear drive, Helical Gear drive.
UNIT - III : (10 Hours) Design of Bevel Gear Drive: Types of bevel gear, proportions of bevel gear, force analysis of bevel gear drive, design of bevel gear drive. Design of Worm Gear Drive: Worm Gearing—AGMA Equation; Worm-Gear force analysis Designing a Worm-Gear Mesh; Buckingham Wear Load.
Teaching Methods: Chalk& Board
TEXT BOOKS : Machine Design, Maleev & Hartman, CBS publishers. 1. Machine Design, P.H. Black, TMH. 2. Mechanical Engg. Design, Shigley, TMH.
REFERENCE BOOKS 1. Hand book of Machine Design, Shigley & Mischke, McGraw Hill. 2. Mechanical Engineering Hand book Vol 1 & 2, Kent, John Willey & Sons. 3. Machine Tool Design Data Book, CMTI. DESIGN DATA HAND BOOKS 1. Design Hand Book by S.M.Jalaluddin ; Anuradha Agencies Publications 2. P.S.G.Design Data Hand Book, PSG College of Tech Coimbatore 3. Machine Design Data Book, K.Lingaiah, Tata Mcgraw Hill.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	THEORY OF PLASTICITY	**3**	**0**	**0**	**3**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Apply principles of elasticity theory to determine stresses and strains
CO2	Apply theory of elasticity and formulate plane stress and plane strain problems
CO3	Solve for stresses and deflection of beams under unsymmetrical bending and to locate shear Centre of thin wall beams
CO4	Analyze solid mechanics problem using classical methods and energy methods

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												
CO2	2	3												
CO3	1	3												
CO4	1	3												
Avg.	1.5	3												

SYLLABUS

UNIT – I: (14 Hours)

Invariance in terms of the deviatoric stresses, representative stress - Engineering and natural strains, cubical dilation, finite strains co-efficients, Octahedral strain, strain rate and the strainrate tensor. Yield criteria for ductile metal - Yield criteria for an anisotropic material. Stress - Strain Relations – Plastic stress-strain relations, Prandtl Roeuss Saint Venant, Levy – Von Mises, Yield locus, symmetry convexity, normality rule.
UNIT – II: (10 Hours) Crystal Plasticity, the crystalline state, crystallographic indices, the preferential planes and directions, critical shear stress, theory of simultaneous slip, slip bands, the plastic bending in crystals, dislocations and crystal growth, polycrystals and grain boundaries
UNIT – III: (10 Hours) Plane plastic strain and the theory of the slip line filed, two dimensional problems of steady and non steady motion, plastic anisotropy.
Teaching Methods: Chalk& Board
TEXT BOOKS : 1. Narayanasamy R, "Theory of Engineering Plasticity", Ahuja Publications, 2000. R.Hill , "The Mathematic theory of Plasticity", Oxford Publication, 1982
REFERENCE BOOKS 1. Johnson and Mellor, "Plasticity for Mechanical Engineers", Ban Nostrand, 1973.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	Dissertation Phase-I	**0**	**0**	**20**	**10**	

Pre -Requisite:

Course Outcomes: *Upon successful completion of this course, students should be able to:*

CO1	Chose a topic in advanced areas of Manufacturing Technology
CO2	Review available literatures to identify gaps and define objectives of research
CO3	Utilize the ideas obtain from literature and develop research methodology
CO4	Develop an experimental set-up and / or computational techniques necessary to meet the objectives.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1				1							1		
CO2	1	1	1	2	1	1		1		1		1		
CO3	1	1			1	1		1		1		1		
CO4	1				1							1		
Avg.	1	0.5	0.2	0.5	1	0.5		0.5		0.5		1		

			5											

IV SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
PRACTICAL / SESSIONAL							
1	ES		Dissertation Phase-II	0	0	32	16
TOTAL				0	0	32	16

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
	DISSERTATION PHASE-II	**0**	**0**	**32**	**16**	
Pre -Requisite:						
Course Outcomes: *Upon successful completion of this course, students should be able to:*						

CO1	Identify methods and materials to carry out experiments/develop code
CO2	Analyze and discuss the results to draw valid conclusions
CO3	Prepare a report as per the recommended format and defend the work.
CO4	Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	2	1	1	1		1		1		1		
CO2		1	1											
CO3	1		1	1	1					1		1		
CO4				1										
Avg.	0.5	0.75	1	0.75	0.5	0.25		0.25		0.5		0.5		