Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M. Tech. Mechanical-Production Engineering

Curriculum Structure

Semester I

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	PE101	Advanced Material & Manufacturing	3	1		4	4	15	15	10	60	100
2	PE102	Metal Forming Technology	3	1		4	4	15	15	10	60	100
3	PE1*3	Elective-I	3	1		4	4	15	15	10	60	100
4	PE1*4	Elective-II	3	1		4	4	15	15	10	60	100
5	PE105	Research Methodology	3			3	3	15	15	10	60	100
6	PE 106	Laboratory Practice-I			4	4	2			50	50	100
		Total	15	04	04	23	21	75	75	100	350	600

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment for theory courses / Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

List of Electives

Elective I

PE 113 - Advanced Machine Tool design
PE 123 - Advanced Tooling and Die design
PE 133 - Costing and Cost Control
PE 143 - Condition Monitoring Techniques

Elective II

PE 114 - Mathematical Modelling and Simulation
PE 124 - MEMS & Nanotechnology
PE 134 - Supply Chain management & logistics

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M. Tech. Mechanical - Production Engineering

Curriculum Structure

Semester II

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	PE201	Optimization Techniques	3	1		4	4	15	15	10	60	100
2	PE202	Advanced Casting Technology	3	1		4	4	15	15	10	60	100
3	PE 203	Production & Operation Management	3	1		4	4	15	15	10	60	100
4	PE2*4	Elective-III	3	1		4	4	15	15	10	60	100
5	PE2*5	Elective-IV	3	1		4	4	15	15	10	60	100
6	PE206	Laboratory Practice -II			4	4	2			50	50	100
7	PE 207	Seminar I			2	2	1			50		50
		Total	15	50	06	26	23	75	75	150	350	650

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment for theory courses / Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

Elective III

PE 214 - Computer Aided Engineering (CAE)
PE 224 - Noise and Vibration
PE 234 - Fabrication Engineering &Welding Technology
PE 244 - Reliability Engineering

Elective IV

PE 215 - Industrial Automation and Robotics
PE 225 - Project Management
PE 235 - Plastic Process & Die Design
PE 245 - Automatic Control Engineering

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M. Tech. Mechanical - Production Engineering

Curriculum Structure

Semester III

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	PE301	Seminar II			2	2	1			50		50
2	PE302	Dissertation Phase I			20	20	10			100		100
		Total	-	-	22	22	11	-	-	150		150

L- LectureT-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment for theory courses / Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

Semester IV

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	PE401	Dissertation Phase II			30	30	20			100	200	300
		Total	-	-	30	30	20	-	-	100	200	300

L- LectureT-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment for theory courses / Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

Government College of Engineering Karad
First Year M. Tech. Mechanical-Production Engineering
PE101: Advanced Material and Manufacturing

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 Understand the latest developments in material science and materials to cope up with requirements of industry.
2 Understand the developments in non-conventional manufacturing processes
3 To provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances
4 To provide a technical understanding of common processes to aid in appropriate material selection for a predetermined process

Course Contents		**Hours**
Unit I	**Review of Engineering Materials**- metals, alloys- ferrous and non-ferrous, plastics and polymers, ceramics and composites. Dual phase steels, micro alloyed steels, High strength low alloy steels, transformation inducted plasticity (TRIP) steels, Maraging steels. Heat treatment of ferrous and nonferrous alloys for modification of structure and properties.	6
	Modern materials- Compositions, properties and applications of: Inter-metallics, Ni and Ti aluminides, smart materials, shape memory alloys, Metallic glass- quassi crystals, Dielectrics, semiconductors, conductors & super conducting materials. Magnetic and photoelectric materials, optical materials, Bio materials, micro electronic materials and nano materials.	
Unit II	**Non Metallic Materials**- Polymer materials, formation of polymer structures, production Techniques of fibers, foams, adhesives and coatings. Structure, properties and applications of engineering polymers. Advanced structural ceramics, WC, TiC, TaC, Al2O3, SiC, Si3N4, CBN and diamond- properties, processing and applications. **Composites**: **Fibers**-glass, boron, carbon, organic, ceramic and metallic fibers- **Matrix materials**- polymers, metals and ceramics. Processing of polymer matrix composites: open mould process, bag molding, compression molding with BMC and SM- filament winding, pultrussion- centrifugal casting, injection molding, applications of PMC's. Processing of metal matrix polymers: solid state fabrication techniques- diffusion bonding, powder metallurgy techniques, plasma spray, chemical and physical vapor deposition of matrix on fibers, Liquid state fabrication methods, Infiltration, squeeze casting, Rheo casting, compo casting. Applications	7
Unit III	**Selection of Materials:** 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 material selection with reference to aero, automobile, marine, machinery and nuclear applications.	7

Unit IV	**Classification and Types of Conventional Manufacturing Processes**- forging, rolling, extrusion, wire drawing, sheet metal processes. Manufacturing automation, Nontraditional manufacturing processes. Economics of nontraditional and automated manufacturing. Introduction to micromachining and MEMS. Introduction to coatings and tribology	6
Unit V	**Rapid Prototyping:** Product development cycle & importance of prototyping. Types of prototypes, principles and advantages and different types of generative manufacturing processes, viz. stereo lithography, FDM, SLS etc. Factors concerning to RP: consideration for adaptations, advantages, accuracy, economic considerations	6
Unit VI	**Non-Conventional Machining Processes**: Introduction and need for non-conventional machining processes, Principle and theory of material removal. Process parameters, advantages, limitations and applications of ultrasonic machining, laser beam machining and electrochemical machining **Special Processes and Electronic Fabrication:** Principles, salient features, advantages and applications of abrasive floor machining, magnetic abrasive finishing, wire EDM, electrochemical grinding, honing, lapping and super finishing. Principles, elements, process, advantages, applications and surface preparation etc. of physical vapor deposition, chemical vapor deposition, electro less coating and thermal metal spraying	7

Tutorial

Eight assignments based on the above syllabus

Course Outcome (CO):

1 Students will be able to select materials according to its application
2 Students will be able to process advanced materials like composites, MEMS, biomaterials etc.
3 Students will be able to do prototype by different rapid prototyping method
4 Students will be able to get critical dimensions in components by non-conventional machining process
5 Students will be able to process electronic components by special processes such as EDM, PVD, CVD etc.

Text Books

1 "Manufacturing Science" - A. Ghosh and Malik – Affiliated East West Press Pvt. Ltd.
2 Agarwal D & Brontman L.J., "Analysis & Performance of Fibre Composites", John Willey Publications, 1990
3 Mallik P.K. & Newman S., Composite Materials Technology", Henser Publications, 1990
4 Krishnan K. Chawla, "Composite Material Science and Engineering", Springer- Verlag, 1987
5 "HMT Handbook" – Production Technology (TMH)

References

1 Willer, "Non- traditional Machining Processes", SME publications.
2 G. F. Benidict, "Advanced Manufacturing Processes", Marcel Dekker Publisher
3 E. Paul DeGarmo, J. T. Black & Ronald A. Kohser, "Materials & Processes in Manufacturing", (PHI)
4 Geoff Eckold "Design & Manufacturing of Composite Structures", (Jaico Publishing House)
5 S. Kalpaljian & Steven R. Schmidt, (Pearson Education) "Manufacturing Processes for Engineering Materials

Useful Links

1 www.asminternational.org
2 www.elsevier.com
3 www.iitd.ac.in/~pmpandey/MEL120

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering Karad
First Year M. Tech. Mechanical-Production Engineering
PE 102: Metal Forming Technology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 To develop fundamental understanding in principles of various metalworking processes
2 To develop an understanding of how these processes are carried out in industry.
3 The objectives of this course to provide a fundamental and quantitative understanding of the principles and practice of metals processing
4 Understand the design considerations and design principles of forming processes such as forming, rolling, wire drawing, sheet metal working, etc.
5. Knowledge about shape-forming, machining, surface treatment, and joining operations in metallic systems ranging from high purity elemental constituents to complex, multi-component alloys is gain

Course Contents

	Hours
Unit I Introduction: Study of various forming processes, their significance with respect to other manufacturing processes, Classification based on volume, stage, complexity; Requirements for near net shape manufacturing	6
Unit II Fundamentals: Mechanics of metal working, stress strain relationship, yield criteria, Equilibrium in Cartesian, cylindrical and spherical coordinates, Slab method and lower and upper bond methods for load, their significance in investigating and modeling of metal working operations; plastic work, work hardening, strain rate and temperature, deformation zone geometry, formability, forming limit diagrams.	7
Unit III Workability: Overview at the workability, workability in sheet metal forming, forging, rolling, and in extrusion and wire drawing. Friction and Lubrication in: Rolling, Drawing, Forging, Extrusion, Drawing of Wire	6
Unit IV Forging: Equipments: Hammers, Presses, interaction between forging process and equipment, Forging materials and practices or processes: Light alloys, titanium alloys and heat resistance alloys. Effect of forging variables on properties; Forging die design: Design principles, Pre form design considerations, Die materials.	6
Unit V Rolling: Classification of Rolling Processes, Rolling mills, Hot- Rolling, Rolling of Bars and Shapes; Forces and Geometrical relationship in Rolling, Simplified analysis of rolling load: variables, problems and defects in rolled products, Rolling mill control, Theories of cold rolling, hot rolling, torque and power, Roll pass design **Extrusion**: Classification of extrusion processes, extrusion equipment, hot extrusion, defects in extrusion, Analysis of the extrusion process, cold Extrusion and cold forming, hydrostatic extrusion, extrusion of tubing, Production of seamless pipe and tubing.	7

Wire Drawing: Introduction, wire drawing, analysis of wire drawing and Residual stress in wire, wire drawing dies.

Unit VI Sheet Metal Forming: Introduction, forming methods, shearing and blanking, bending, stretch forming, deep drawing, forming limit criteria, Defects in formed parts.

7

Latest Trends in Forming: Isothermal forging, Near net shape manufacturing, thermo- mechanical treatments, High Energy Rate Forming (HERF), super plastic forming technology, hydro forming, Laser beam forming, fine blanking

Tutorial

1 Eight assignments based on syllabus

Course Outcome (CO):

1 Students will able to select various forming process based on complexity
2 Students will able to execute various stress analysis software by getting advanced stress analysis system
3 Students will able to learn the design principles and design considerations of metal forming processes such as forging, rolling, extrusion etc.
4 Students will learn the latest forming technology such as HERF, hydro forming
5 Students will able to understand competent design, execution, and assessment of the methods used for solidification. thermal treatment

Text Books

1 George E. Dieter - Mechanical Metallurgy, McGrew Hill, London, 1988
2 G. E. Dieter - Workability Testing Techniques, American Society for Metals, Metals Park, 1984
3 Metal Forming Handbook, -Schuler, Springer-Verlag Berlin Heidelberg New York, (2008)
4 R. Sharan, S.N. Prasad - Forging Design and Practice
5 Forging Equipment, Material and Processes, J. Altan, F. W. Boulger - Metals Ceramic Information Center, Columbus

References

1 Roll Forming Handbook, - Geotge T. Halmos, (CRC Press, Taylor & Francis)
2 Panneer selvam – Research Methodology
3 Metal Forming Fundamentals & Applications – Alan T, American Society of Metals, Metal Park 1983
4 Metal Forming Mechanics & Metallurgy, Hosford WF and Cadell R.M. , Prentice Hall, Englewood Cliffs, 1993
5 ASM Hand Book - Forming and Forging, 9/e, Volume 14, (1998)

Useful Links

1 eng.sut.ac.th/metal/
2 faculty.ksu.edu.sa
3 web.iitd.ac.in/~pmpandey
4 www.cimatron.com/SIP
5 www.autosteel.org

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
	√				√	√								
CO1			√								√	√		
CO2		√											√	
CO3					√						√			√
CO4			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 113: Elective I - Advanced Machine Tool Design

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Understanding of how the static and dynamic strength parameters for a material are measured in standardized tests
2. Ability to calculate the stress distribution for axial and shear forces, bending moments and torques in objects with simple shapes using the "strength of materials" approach.
3. Ability to conduct a failure analysis for the design/sizing of mechanical components
4. Ability to calculate the stress resultants at any point of a three dimensional object subject to arbitrary loading

Course Contents		**Hours**
Unit I	**Introduction:** Classification of machine tools based on their construction, precision, control, drives and rate of production (General purpose machines, special purpose machines and CNC machine tools), **Kinematics of Machine Tool**: - Classification of kinematic systems used for motions of various elements of machine tools	6
Unit II	**Drive Systems**: - Selection of cutting speeds, and speed range, method of speed regulation, stepped, step-less, mechanical, electrical, hydraulic methods of speed regulation and their comparison. Stepped drives of machine tools- Gear drives, Gear box design, graphical Representation of gear box operation with ray diagram, structure diagram, deviation diagram. Drives for CNC machine tools- AC and DC servomotors, Stepper motors.	7
Unit III	**Analysis for Strength and Rigidity**: Consideration used in design for strength and rigidity, Structural analysis of various elements of machine tools such as beds, frames, slides, tables and screws, Structural design of beds for lathes, milling and drilling machines	6
Unit IV	**Dynamics of Machine Tools:** Effects of vibration, determination of natural frequency of vibration of machine structures, sources of vibration, analysis of single degree of freedom chatter, Vibration analysis of machine tool structure by partial differential equations, finite element analysis (FEA) techniques, Testing of machine tools **Design of Spindles:** Various types of spindles, spindles support, friction/anti-friction bearings, hydro and aerostatic bearings; friction and antifriction screws, friction and anti-friction slide ways, design calculations of spindles- deflection of spindle, optimum spacing between spindle support.	7
Unit V	**Control systems**:- Various controls introduced on machine tools and their importance, various systems such as mechanical, electrical, electronics, optical, pneumatic/hydraulic systems used for position control, their application in automation, various stages of automation, devices for CNC machines - feedback devices, controllers	6

Unit VI **Special Purpose Machines**: Requirement analysis, design considerations, drives, transmission and controllers, Modular design of machine tools 7

Tutorial

1 Design of at least two elements of machine tool - analytical and using FEA
2 Design of one sub- assembly like gear box, feed box, with design report and assembly detail drawing.
3 Design of a special purpose machines for suitable application- calculations, layout preparation
4 Case study on selection of drives for CNC machines

Course Outcome (CO):

1 Students will able to do failure analysis of mechanical components
2 Students will able to design drive systems for tool
3 Students will able to design control systems for tool
4 Student will able to work on various tool design software by studying mechanics of tool
5 Students will able to perform on special purpose machines

Text Books

1 N.K Mehta, (2005), Machine Tool Design & Numerical Control- TMH.
2 Sen & Bhattacharya, (2005), Principles of Machine Tools, - New Central Book Agencies
3 Yoram Koren, (2005) Computer Control of Machine Tools, McGraw Hill.
4 Nagpal, G.R., (2003), Machine Tool Engineering, - Khanna Publications
5 S.K. Basu & D. K. Pal (2001), Design of Machine Tool Design, - Oxford IBH Publishing Co

References

1 Machine Tool Design Handbook – CMTI, TMH
2 Machinery's Handbook, (24/e) Ed. Henry H. Ryfeel, Industrial Press Inc.
3 P. H. Joshi, (2007) Machine Tools Handbook: Design and Operation - McGraw Hill
4 Yoshimi Ito, (2008), Modular Design of Machine Tools, McGraw Hill
5 Dr. Geo Schlesinger, Testing machine Tools, The Machinery Publishing Co. Ltd., Industrial Press, London

Useful Links

1 www.skf.com
2 www.mech.utah.edu
3 www.springer .com
4 www.sciencedirect.com

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 123: Elective I - Advanced Tooling and Die Design

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorials	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To study principles of designing fixtures and dies for industrial applications
2. Training of the technical personnel in design and manufacturing of tools, Jigs & fixture, dies & moulds, press tools, CAD/CAM and CNC techniques
3. Design and development of tools for various processes, calibration of Mechanical Measuring Instruments
4. Recommending measures to standardize tools and tooling elements, components of Jigs & Fixtures, Dies & Moulds, Press Tools and other tools

Course Contents **Hours**

Unit I Introduction: Jigs and Fixtures, Flexible Fixturing, Materials for Tools, Fixture and Dies — 5

Unit II Modular Fixture Systems: Development of modular fixtures, T- slot based and Dowel pin based Modular Fixture systems, Interactive Computer Aided Fixture Design (I-CAFD) Structure, Locating / clamping Model Analysis and classification, Fixture Component Selection, Fixture component Assembly Manipulation — 8

Unit III Group Technology based Computer Aided Fixture Design: Fixture Design process analysis, Fixture Structure Analysis, Fixture Feature Analysis, Fixture Design Similarity Analysis, Representation of Fixturing Feature information, Automated Fixture configuration Design

Geometric and Accuracy Analysis: Geometric constraint conditions, Assembly Analysis, 3D Fixture configurations, Locating Accuracy and Error analysis, clamp planning, Machining accuracy analysis — 7

Unit IV Die Design for Deep Drawing and Stretch Drawing: design considerations, die materials, efforts of friction, wear and lubrication, Die handling, Die clamping, dies for hydro mechanical deep drawing — 7

Unit V Die Design for Hydro Forming: Process Technology, Die design considerations, die layout, die clamping, and lubricants. — 6

Unit VI Extrusion Dies: Die Design for metal extrusion, die materials, die clamping, die handling, Dies for Solid Sections, Dies for hollow section. — 6

Tutorial

1. Case Study of T- Slot based Modular Fixturing system.
2. Case Study of Dowel pin based Modular Fixturing system
3. Computer Aided Fixture Design for Simple Component.

4 Die Design for stretch drawing operation for a component.
5 Extrusion die design for solid section
6 Study of die clamping systems for various processes.

Course Outcome (CO):

1 Students will able to design fixtures and die
2 Students will able to design tools for various processes
3 Students will able to take measures to standardize tools and tooling elements, components of Jigs & Fixtures, Dies & Moulds, Press Tools and other tools
4 Students will able to do computer aided fixture design
5 Students will able to do calibration of instruments

Text Books

1 Rong, Yeming; "Computer Aided Fixture Design", Marcel Dekker,
2 Metal Forming Handbook – Schuler, Springer- Verlag Berlin
3 Dies for Plastic Extrusion – M.V. Joshi – McMillan
4 Tool Design – C. Donaldson, Le Cain & Goold (TMH)
5 Tool Design – H.W. Pollack (Taraporwalla)

References

1 ASM Handbook – Forming – ASME
2 Handbook of Die Design, 2/e – Suchy, I (McGraw Hill)
3 Design of Jigs and Fixtures – Hoffman (Pearson)
4 An Introduction to Jig & Tool Design, M.H.A. Kempster, (ELBS)
5 Jigs and Fixture Design Manual, Henrikson (Industrial Press, NY)
6 Die Design Fundamentals, J. R. Paquin, R. E. Crowley, Industrial Press Inc.
7 Jigs & Fixtures; Design Manual – (2/e), P.H. Joshi, (TMH)
8 A.Y. C. Nee, K. Whybrew& A. Senthil kumar, Advanced Fixture Design for FMS, Springer

Useful Links

1 www.scribd.com/doc/
2 www.psgias.ac.in
3 www.cimatron.com
4 www.inl.gov/technicalpublication

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 133: Elective I - Costing and Cost Control

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Identify and calculate different types of costs (direct, indirect, variable, and fixed costs)
2. Distinguish between job-costing, process-costing, and joint-costing systems
3. Determine the product cost by means of full- costing and direct-costing methods
4. Determine the product cost by means of historical (actual) and standard cost systems
5. To develop an understanding of students to utilize cost data in planning and control
6. State and evaluate choices between alternative product costing systems and methods in a cost-benefit context

Course Contents **Hours**

Unit I **Introduction:** (a) Concept of cost, cost unit, cost center, classification of cost, different costs for different purposes. (b) Definition of costing, cost-price-profit equation, desirable conditions for a costing system

Cost Estimating: Definition, purpose and functions of estimation, role of estimator, constituents of estimates, estimating procedures. 5

Unit II Estimation of Weight and Material Cost: a) Process of breaking down product drawing in to simpler elements or shapes, estimating the volume, weight and cost b) Review of purchasing procedure, recording of stock and consumption of material by LIFO, FIFO, Weighted average method

a)Estimation of fabrication cost : Constitutes, direct cost, indirect cost, Procedure of estimation of fabrication cost;

b) Estimation of foundry cost: Constitutes, direct cost, indirect cost, Procedure of estimation foundry cost 8

c) Estimation of forging cost: Constitutes, direct cost, indirect cost, Procedure of estimation of forging cost.

d) Estimation of machining cost: Constituents, direct cost, indirect cost, Procedure of estimation of machining cost.

Unit III Machine hour rate: definition, constituents, direct cost, indirect cost, steps for estimation of machine hour rate for conventional machines, CNC lathe and machining center 6

Labour Cost – Direct and indirect labour, Workmen classification, Definition of wages, Methods of remuneration.

Unit IV Overheads: Elements of overheads, classification, general considerations for collection, analysis of overheads, different methods for allocation, apportionment, absorption of overheads, 6

Unit V Cost Accounting Methods: Job costing, Batch costing, Unit costing, Process costing, Contra.

Cost Control: Use of cost data for policymaking and routine operation, control techniques such as budgetary control, standard cost, variance analysis, marginal cost and break even analysis of costing, Activity based costing 8

Unit VI **Cost Reduction Areas:** Procedures and systems in product, methods and layouts, administrative and marketing, rejection analysis, cost of poor quality, value analysis and value engineering, Zero Base Budgeting 6

Tutorial

1 Estimation of weight and material cost for an assembly of three to five components.
2 Valuation of inventory by LIFO, FIFO, Weighted average method
3 Estimation for machine hour rate for representative machines – one conventional machine and one CNC lathe or machining center
4 Case study on estimation of overheads for a manufacturing unit
5 Study of different methods for allocation, apportionment, absorption of overheads
6 Case study in any one industry using any of the method of costing.
7 Different examples illustrating cost control
8 Case studies of cost reduction (Min. 2)

Course Outcome (CO):

1 Students will able to identify and calculate different types of costs (direct, indirect, variable, and fixed costs)
2 Student will able to calculate cost of product, process or joint cost
3 Students will able to utilize cost data in production planning and control
4 Students will able to evaluate choices between alternative product costing systems and methods in a cost-benefit context
5 Students will able to determine the product cost by means of historical (actual) and standard cost system

Text Books

1 Principles & Practice of Cost Accounting – N. K. Prasad (Book Syndicate Pvt. Ltd.)
2 Costing Simplified: Wheldom Series – Brown & Owier (ELBS)
3 Cost Accounting: B. Jawaharlal (TMH)
4 Cost Accounting: R.R. Gupta
5 Cost Accounting, 13/e - B. K. Bhar, (Academic Publishers, Kolkata)

References

1 Cost Accounting: Jain, Narang (Kalyani Publishers)
2 A Text Book of Estimating and Costing Mechanical – J.S. Charaya & G. S. Narang (Satya Prakashan)
3 Mechanical Estimation and Costing – TTTI, Chennai (TMH)
4 Theory & Problems of Management & Cost Accounting – M.Y. Khan, P. K. Jain (TMH)

Useful Links

1 http://online.vmou.ac.in
2 www.universityofcalicut.info
3 cset.mnsu.edu/cm/
4 www.simon.rochester.edu
5 Ebooks.narotama.ac.id

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 143: Elective I - Condition Monitoring Techniques

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorials	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 To get knowledge about how to avoid extraneous outages or damages due to unexpected failures in equipment
2 Understand the basic causes of vibration and remedial measures to faults.
3 To enable the students with various vibration measuring techniques and give hands on practice on the equipments

Course Contents **Hours**

Unit I Plant and plant management

Maintenance function
Maintenance cycle
Planning, execution, recording and evaluation. types of maintenance; preventive and corrective maintenance; condition based maintenance and condition monitoring; monitoring and control systems with power and process plant, failure characteristics including diagnostic statistics, plant management and maintenance strategies, cost effectiveness — 5

Unit II Signal analysis

Basic concepts
Fourier analysis, bandwidth, signal types, convolution
Signal analysis
Filter response time, detectors, recorders, analog analyzer types — 8
Practical analysis of stationary signals:
Stepped filter analysis, swept filter analysis, high speed analysis, real-time analysis

Unit III Different condition monitoring techniques and methods

Condition monitoring techniques
Vibration monitoring, acoustic emission monitoring, oil analysis, particle analysis, ultrasonic monitoring, thermography — 6
Vibration monitoring methods:
Vibration data collection, techniques, instruments, transducers, commonly witnessed machinery faults diagnosed by vibration analysis

Unit IV Measurement systems

Description of basic measurement systems, transducers (e.g. accelerometers) and their static and dynamic behaviour, block diagram representation of general transducer, analysis of errors using simple statistics — 8

Unit V Transmitting signals for monitoring and control

Signal conditioning and signal processing, open-loop and feedback systems applied to measurement systems, analogue to digital conversion, sampling and anti-aliasing filters, communications in instrumentation systems — 6

Unit VI Fault diagnosis

Condition monitoring in real systems

Diagnostic tools, condition monitoring of gear box and machines, approaches to fault diagnosis, interpretation of condition monitoring data, technologies for data interpretation including Knowledge-Based Systems and Artificial Neural Networks 6

Course Outcome (CO):

1 Students will able to practice of preventive failure of machine components
2 Students will able to handle different condition monitoring measurement systems
3 Students will able to handle different fault diagnostic tools
4 Students will able to work on plant and plant management
5 Students will able to perform maintenance function

Tutorial

Eight assignments based on syllabus.

Text Books

1 P Girdhar – Machinery vibration analysis and predictive maintenance, Elsevier Newnes Publications
2 Collacot R.A.- Mechanical fault diagnosis and condition monitoring, London : Chapman and Hall
3 Rao, B. K. N. (1996), Handbook of condition monitoring, Elsevier advanced technology, Oxford
4 A Davis – Handbook of condition monitoring, London : Chapman and Hall
5 John S Mitchell – Machinery analysis and monitoring, Penn Well Publishing, Tulsa, Okla

References

1 R G Eisenmann et-al – Machinery malfunction diagnosis and correction Pearson Publication
2 Robert Bond Randall Vibration-based Condition Monitoring: Industrial, Aerospace and Automotive Applications (Google eBook) John Wiley & Sons
3 Ron Barron, Engineering condition monitoring: practice, methods and applications, Longman
4 E. D. Yardley, Condition Monitoring: Engineering the Practice, Wiley

Useful Links

1 www.nrel.gov/docs/
2 www.plant-maintenance.com
3 www.krelco.com
4 www.ni.com

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 114: Elective II - Mathematical Modelling and Simulation

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Translate physical systems with mechanical, fluid, thermal and/or electrical elements in to mathematical models governed by ODEs
2. Understanding distributed modelling of structural, thermal and fluid flow systems governed by PDEs
3. Analytical solutions to mathematical models and interpretations
4. Application and implementation on practical systems
5. Numerical solutions using MATLAB

Course Contents		**Hours**
Unit I	**Review of engineering mathematics**: Relations, Functions, limit, continuity, differentiability, Calculus (differentiation & integration), Solution to Ordinary Differential Equations, Classical Methods, Laplace Transform, Inverse Laplace Transform and its Properties, Linear algebra, Vectors, Probability and Statistics	10
Unit II	**Lumped Parameter Modeling of Mechanical Systems:** Elemental & System Equations Work, Energy, & Power Transforming Elements, modelling of single and Multi-Degree of Freedom Systems (Eigen value problem) **Fluidic & Thermal Systems**: Liquid-Level Systems, Hydraulic/Pneumatic Systems, Thermal Systems **Electrical Systems:** Elemental & System Equations (LCR circuits), Method of Complex Impedances Electromechanical Systems Linearization of Nonlinear Systems	4
Unit III	**Distributed modelling of Continuous systems (PDEs): Structural/Mechanical Systems:** Beam & Plate Static and Dynamic Models, Time/Frequency Response Analysis of Dynamic Systems,	6
Unit IV	**Modelling of thermal systems:** 1D & 2D steady and transient heat transfer	6
Unit V	**Modelling of fluid flow systems:** Conservation equations for mass, momentum and energy, steady and unsteady flows, solutions, interpretations and significance of N-S equation for following cases (i) Steady laminar flow (ii) Flow past an impulsively started flat plate (iii) Boundary layer flow along a flat plate (iv) Inviscid flow past an airfoil (v) Impulsively started flow of an inviscid fluid (vi) Steady viscous flow past a cylinder (vii) Unsteady flow past an airfoil	8
Unit VI	**Introduction to MATLAB**	6

Tutorial Eight assignments based on syllabus

Course Outcome (CO):

1 Students will able to do mathematical modelling of Physical systems of structural, thermal and fluid domains using lumped parameter approach

2 Students will able to do mathematical modelling of Physical systems of structural, thermal and fluid domains using distributed parameter approach

3 Students will be able to perform computer simulations of different mathematical models

4 Hands on practice on FFT analyser for different application

5 Hands on practice on modal hammer kit for different application

Text Books

1 Advanced engineering mathematics / Erwin Kreyszig

2 K. Ogata, System Dynamics by 2/ed, Prentice Hall, 1992.

3 Kuo, B.C., Automatic Control Systems, 7/ed, Prentice Hall, 1995.

4 Ogata. *Modern Control Engineering*. 3rd ed. Upper Saddle River, NJ: Prentice Hall, 1996

5 Rowell and Wormley. *System Dynamics: An Introduction*. Upper Saddle River, NJ: Prentice Hall, 1996.

6 Dorf and Bishop. *Modern Control Systems*. 7th ed. Reading, MA: Addison-Wesley, 1995

References

1 Franklin, G. F., J. D. Powell, A. Emami-Naeini, Feedback Control of Dynamic Systems, 2/ed, Addison-Wesley, 1991. [1] J.L. Shearer and B.T. Kulakowski, Dynamic Modeling and Control of Engineering Systems, Mcmillan Publishing Company, 1990.

2 Van de Vegte, J., Feedback Control Systems, 2/ed, Prentice Hall, 1990.

3 Solving Control Engineering Problems with MATLAB by K. Ogata, Prentice-Hall, 1994 (MATLAB Reference)

4 Nise, Norman S. *Control Systems Engineering*. 5th ed. New York, NY: John Wiley & Sons, 2007.

Useful Links

1 ocw.mit.edu

2 www.eolss.net

3 www.springer.com

4 nptel.ac.in

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						
CO6														

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 124: Elective II - MEMS & Nanotechnology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 To understand the concepts and context of MEMS and nanotechnology
2 Separate a microsystem into simple parts ("lumped elements") modeled in different physical domains
3 Calculate the static and dynamic behaviour of simple mechanical microsystems, e.g. cantilevers and membranes
4 Evaluate and choose transduction principles (e.g., electrostatic or magnetic) for actuation in a microsystem and perform analytical calculations for a simple actuator based on them
5 Evaluate and choose transduction principles (e.g., capacitative or piezoresistive) for sensors in a microsystem and perform analytical calculations for a simple sensor based on them

Course Contents **Hours**

Unit I Introduction: Micro-Electro-Mechanical Systems (MEMS), Microsystems and their products, miniaturization, applications, mechanical MEMS, thermal MEMS, micro-opto electro-mechanical systems, magnetic MEMS, radio frequency (RF) MEMS, micro fluidic systems, bio and chemo devices, nanotechnology – definition, nano scale, consequences of the nano scale for technology and society, need and applications of nano electromechanical systems (NEMS) 6

Unit II Micro Fabrication Processes & Materials: Materials for MEMS – substrate and wafers, silicon as a substrate material, crystal structure, single crystal and polycrystalline, mechanical properties, silicon compounds, silicon piezo-resistors, gallium arsenide, quartz, piezo-electric crystals, polymers, packaging materials; **Fabrication Processes** – Bulk micro-manufacturing, photolithography, photo resists, structural and sacrificial materials, X-ray and electron beam lithography, Thin film 8 deposition – spin coating, thermal oxidation, chemical vapour deposition(CVD), electron beam evaporation, sputtering; Doping – diffusion, ion implantation; Etching
–wet etching, dry etching; Surface micromachining, bulk vs. surface micromachining; Wafer bonding – glass-frit, anodic and fusion bonding; LIGA process and applications.

Unit III Micro sensors and actuators: Sensing and actuation, Chemical sensors, Optical sensors, Pressure sensors, Thermal sensors –thermopiles, thermistors, micro machined thermocouple probes, thermal flow sensors, MEMS magnetic sensor,
Piezoelectric material as sensing and actuating elements – capacitance, piezo mechanics, Piezo actuators as grippers, micro grippers, micro motors, micro valves, micro pumps, micro accelerometers, micro fluidics, shape memory alloy based optical switch, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever. 8

Unit IV **Microsystem Design:** Design constraints and selection of materials, selection of manufacturing process, selection of signal transduction technique, electromechanical system and packaging. 5

Unit V **Nano materials:** Molecular building blocks to nanostructures – fullerenes, nano scaled bio molecules, chemical synthesis of artificial nanostructures, molecular switches and logic gates, nano-composites; Carbon nano tubes - structure, single walled, multi walled, properties of carbon nanostructures and their synthesis, Potential applications of nano-structures. 6

Unit VI **Nano finishing Techniques**: Abrasive flow machining, magnetic abrasive finishing, magneto rheological finishing, elastic emission machining, ion beam machining, chemical mechanical polishing, Nano manipulation, Nanolithography, Top-down versus bottom –up assembly, Visualization, manipulation and characterization at the nano scale; Applications – in Energy, Tribology ,informatics, medicine, etc. 6

Tutorial

1 Eight assignments based on syllabus

Course Outcome (CO):

1 Students will able to design MEMS
2 Students will able to apply knowledge of nano-technology
3 Students will able to select special materials for MEMS
4 Students will able to calculate the static and dynamic behavior of simple mechanical microsystems, e.g. cantilevers and membranes
5 Students will able to perform special nano finishing techniques

Text Books

1 Bharat Bhushan (Ed.), (2004), Handbook of Nanotechnology, Springer-Verlag Berlin Heidelberg New York, ISBN 3-540-01218-4
2 Hsu, Tai-Ran, (2003), MEMS & MICROSYSTEMS: Design & Manufacture, TMH, ISBN:0-07-048709-X
3 Mahalik, N. P., (2007), MEMS, TMH
4 Mahalik, N.P. (Ed.) (2006), Micro manufacturing& Nanotechnology, Springer India Pvt. Ltd.

References

1 Nano systems: Molecular Machinery, Manufacturing & Computation, K E Drexler, (Wiley)
2 P.Rai- Choudhury, Handbook of Microlithography, Micromachining and micro fabrication
3 David Ferry, Transports in Nanostructures, Cambridge University Press, 2000
4 Poole, Charles & Owen, Frank J., - Introduction to Nanotechnology, Wiley (India) Pvt. Ltd.

Useful Links

1 www.nanotechweb.org
2 www.nanotec.org.uk

Mapping of CO and PO

CO1		**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO2	1	√				√	√								
CO3	2			√								√	√		
CO4	3		√											√	
CO5	4					√						√			√
CO6	5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	2	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 134: Elective II - Supply Chain Management & Logistics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 Understand and implement concepts, techniques and applications that underpin supply chain management

2 Apply systemic thinking to manage a supply chain

3 Integrate, co-ordinate, and synchronize activities of a supply chain

4 Link strategic and operational system thinking with appropriate action to inform and facilitate day-to-day decisions in supply chain management (ability to integrate, collaborate and synchronize)

5 Articulate and deliver quality outcomes in a customer focused environment

Course Contents		**Hours**
Unit I	**Introduction** and overview of supply chain management, inbound and outbound logistics, and supply chain as a source of competitive advantage. Definition of logistics and SCM, evolution, scope, importance and decision phases – drivers of sc performance and Obstacles	6
Unit II	**Supply Chain Network Design**: distribution in supply chain – factors in distribution network design –design options-network design in supply chain – framework for network Decisions - managing cycle inventory and safety. **Sourcing and Pricing in Supply Chain**: supplier selection and contracts – design collaboration - procurement process. Revenue management in supply chain	8
Unit III	**Strategic Considerations for Supply Chain**: porter's industry analysis and value-chain models, the concept of total cost of ownership, supply stream strategies, classification and development guidelines, measuring effectiveness of supply management, logistics engineering. **Operations Research Models** for operational and strategic issues in supply chain management. The bullwhip effect and supply-chain management game. Coordination and technology in supply chain, effect of lack of co-ordination and obstacles – Information Page 24 of 46 Technology and SCM - supply chain-IT framework. E-business and SCM. Metrics for supply chain performance	8
Unit IV	**Logistics Management**: Definition of logistics and the concepts of logistics. Logistics Activities: Functions of the logistics system – facility location, transportation, warehousing, order processing, information handling and procurement, Logistics environment, Logistics information systems, Logistics audit and control **Inbound Logistics**: Buyer-Vendor co-ordination, procurement, Vendor development, reduced sourcing and supplier partnership - benefits, risks and critical success factors, multi-level supply control.	6

Unit V **Distribution Management**: Outbound logistics, Facility location, Classical location problems, Strategic planning models for location analysis, location models, multi objective analysis of location models.
Transportation alternatives and technologies; transportation performance analysis; total transportation cost analysis; fleet development and management; fleet performance indicators; routing and scheduling; shipment planning; vehicle loading; transportation
management and information systems requirements — 6

Unit VI **Logistics in the Design and Development Phase:** Design Process, Related Design Discipline, Supplier Design Activities, Design Integration and Reviews, Test and Evaluation.
Logistics in the Production Phase: - Production Requirements, Industrial Engineering and Operations Analysis, Quality Control, Production Operation, Transition from Production to user operation. — 6
Logistic in the Utilization and Support Phase: - System / Product Support, TPM, Data Collection, Analysis and System Evaluation, Evaluation of Logistic Support Elements, System Modification

Tutorial

Eight assignments based on syllabus

Course outcome (CO):

1 Students will able to manage a supply chain
2 Students will able to integrate, co-ordinate, and synchronize activities of a supply chain
3 Students will get exposure of logistics
4 Students will able to do sourcing and pricing in supply Chain
5 Students will able to get knowledge of effect of lack of co-ordination and obstacles

Text Books

1 David Bloomberg, Stephen LeMay, Joe Hanna, (2002): Logistics, Prentice Hall
2 Thomas Teufel, Jurgen Rohricht, Peter Willems: SAP Processes: Logistics, Addison-Wesley, 2002
3 Julien Bramel, David Simchi-Levi. (2006), The logic of logistics: theory, algorithms, and applications for logistics management, Springer
4 Murphy, G.J. "Transport and Distribution", 2/e, Business Books
5 Ballou, R.H., Business Logistics Management/Supply Chain, 5/e, 2004, Prentice-Hall

References

1 Martin Christopher, Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service.2/e, Pearson Education Asia
2 Sunil Chopra, Peter Meindl and D.V. Kalara, (2007), Supply Chain Management, Strategy, Planning, and operation, 3/e , Pearson Education
3 Benjamin S. Blanchard, (2009), Logistics Engineering & Management, 6/e, Prentice Hall of India
4 Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Martin Christopher, Pearson Education Asia, Second Edition
5 Modeling the supply chain, Jeremy F. Shapiro, Thomson Duxbury, 2002
6 Handbook of Supply chain management, James B. Ayers, St. Lucle Press, 2000

Useful Links

1 www.utdallas.edu
2 www.scmr.com
3 www.nitc.ac.in
4 Ocw.mit.edu

Mapping of CO and PO

CO1	**A**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO2	√				√	√								
CO3			√								√	√		
CO4		√											√	
CO5					√						√			√
CO6			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 105: Research Methodology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Total credits	3	**CT2**	15
		TA	10
		ESE	60

Course Objectives

1 Understand some basic concepts of research and its methodologies
2 Identify appropriate research topics
3 Select and define appropriate research problem and parameters
4 Prepare a project proposal (to undertake a project)
5 Organize and conduct research (advanced project) in a more appropriate manner and write a research report and thesis

Course Contents		**Hours**
Unit I	**Introduction**: Meaning and objectives of research, Types of research, Research approaches, Research process, Research problem, Selection of research problem, Defining research problem, Literature review, Meta-analysis, Effect sizes, Integrating research findings, identification of research gaps, Errors in research	6
Unit II	**Research Design**: Meaning, need, and features of good design, Dependent, independent, and extraneous variables, Experimental and control groups, Treatments, Experiment,()Research designs in exploratory studies, Research designs in descriptive studies, Experimental research designs (informal and formal), Replication, Randomization, Blocking	7
Unit III	**Sampling**: Need for sampling, Population, Sample, Normal distribution, Steps in sampling, External validity and threats, Sampling error, Probability sampling, Random sampling, Systematic sampling, Stratified sampling, Cluster sampling, Student's t-distribution, Standard error, Determination of sample size **Measurement Techniques**: Measurement scales, Errors in measurement, Content validity, Criterion-related validity, Construct validity (convergent and discriminant),Reliability, Rating scales, Paired comparison, Differential scales, Summated scales, Cumulative scales, Factor scales	6
Unit IV	**Data Collection and Analysis**: Primary data collection through observations and interviews, Questionnaire surveys, Secondary data collection, Data processing, Measures of central tendency and dispersion, mean, median, mode, range, variance, standard deviation, inter-quartile range, histogram, box-plot, normal probability plot, Measures of association	6
Unit V	**Hypothesis Testing**: Null and alternative hypothesis, Level of significance, Type I and type II error, Two-tailed and one-tailed tests, Procedure of hypothesis testing, Power of hypothesis test, Hypothesis testing of means, Hypothesis testing of mean difference	7

	Analysis of Variance: Introduction, One-way ANOVA, Two-way ANOVA, Preparation of ANOVA Table and calculation of F-ratio	
Unit VI	**Analysis of Variance**: Introduction, One-way ANOVA, Two-way ANOVA, Preparation of ANOVA Table and calculation of F-ratio	7

Course Outcome (CO):

1	Student will able to understand basic concepts of various research areas
2	Student will able to identify appropriate research topics concerned to Engineering field
3	Student will select and define appropriate research problem and its related parameters
4	Student will able to prepare a project proposal to investigate expected results/outcomes from a project
5	Student will able to develop a skill of writing/publishing a research paper/topic in conferences and reputed journals

Text Books

1 Montgomery, Douglas C. (2007) – Design & Analysis of Experiments, 5/e. (New Delhi)

2 Montgomery, Douglas C. &Runger, George C. (2007) – Applied Statistics & Probability

3 Panneer selvam – Research Methodology

4 C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006

5 Bendat and Piersol, Random data: Analysis and Measurement Procedures, Wiley Interscience, 2001

6 Shumway and Stoffer, Time Series Analysis and its Applications, Springer, 2000

7 Jenkins, G.M., and Watts, D.G., Spectral Analysis and its Applications, Holden Day, 1986

References

1 Ranjit Kumar, (2006), Research Methodology- A Step-By-Step Guide for Beginners,(Pearson Education, Delhi)

2 Trochim, William M.K., (2003), 2/e, Research Methods, (Biztantra, Dreamtech Press, New Delhi)

3 Richard I Levin amp; David S. Rubin, Statistics for Management, 7/e. Pearson Education, 2005

4 Krishnaswamy, K. N., Sivakumar, Appa Iyer and Mathirajan, M. (2006), Management Research Methodology: Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)

5 Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006

Useful Links

1 https://www.explorable.com/research-methodology

2 http://www.socscidiss.bham.ac.uk/methodologies.html

3 http://www.humanities.manchester.ac.uk/studyskills/methodology.html

4 http://www.palgrave.com/choosing-appropriate-research-methodologies

Mapping of CO and PO

	A	b	C	d	e	f	g	h	i	j	k	L
CO1	✓							✓				
CO2		✓			✓						✓	✓
CO3		✓	✓							✓	✓	✓
CO4		✓	✓	✓	✓		✓	✓				
CO5			✓		✓				✓		✓	✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	0	05
Understand	3	3	2	05
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering Karad
First Year M. Tech. Mechanical-Production Engineering
PE 106: Laboratory Practice

Laboratory Scheme		**Examination Scheme**	
Practical	2 Hrs/week	**CA**	50
Total Credits	1	**ESE**	50

Course Objectives

1 Students will be acquainted with the basic knowledge on fundamental metal forming processes.
2 The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection.
3 To select materials on the basis of application and properties
4 To learn the failure analysis of the components.

Course Contents

Experiment 1 Low cycle fatigue test

Experiment 2 Selection of material and processes

Experiment 3 Case study- Failure analysis of components

Experiment 4 Industrial visit to sheet metal industry

Experiment 5 Industrial visit to forging industry

Experiment 6 Industrial visit to rolling mill/ wire drawing/ Extrusion industry

Experiment 7 Experiment based on the contents of Elective I

Experiment 8 Experiment based on the contents of Elective I

Experiment 9 Experiment based on the contents of Elective I

Experiment 10 Experiment based on the contents of Elective II

Experiment 11 Experiment based on the contents of Elective II

Experiment 12 Experiment based on the contents from Elective II

List of Submission

1 Total number of Experiments 12
2 Field Visit Report any two

Course Outcome (CO):

1 Students will acquire basic knowledge of metal forming processes.
2 Students will able to select materials on the basis of application and properties
3 Students will be able learn the design principles and the design considerations of metal forming processes.
4 Students will able to know fatigue strength of component

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	√											
CO2			√					√		√	√	
CO3	√	√	√		√						√	
CO4	√	√			√		√	√		√		

Assessment Pattern

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	CA	ESA
Assembling														
Testing							2	2	2	2	2	2	2	4
Observing				4	4	4	3	3	3	3	3	3	3	6
Analyzing				6	6	6	10	10	10	10	10	10	10	10
Interpreting				20	20	20	10	10	10	10	10	10	10	10
Designing														
Creating														
Deducing conclusions				20	20	20	20	20	20	20	20	20	20	20

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 201: Optimization Techniques

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems
4. To recognize and formulate problems that arise in engineering in terms of optimization problems
5. To give students understanding, tools and some experience of how such problems are solved

Course Contents		**Hours**
Unit I	**Linear models:** **Linear programming-extensions**: Revised simplex method, Dual Simplex method, Bounded variables method, primal-dual relationships, duality theorems, economic interpretation of dual, dual of transportation model, sensitivity analysis in LPP and transportation models, Karmarkar's interior point algorithm	6
Unit II	**Dynamic programming**: Formulation, recursive approach, Goal programming: formulation, graphical solution, algorithm **Integer programming**: Formulation, Cutting plane algorithm, Branch and bound algorithm	7
Unit III	**Nonlinear models:** **Classical Optimization**: Single and Multi-variable Optimization, Hessian Matrix, Saddle Point, Lagrange Multipliers, Kuhn-Tucker Conditions	7
Unit IV	**Single-variable Optimization:** Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval-halving Method, Fibonacci Method, Golden-section Method, Quadratic Interpolation Method, Newton Method, Quasi-Newton Method, Secant Method **Multi-variable Optimization:** Evolutionary Optimization Method, Simplex Search Method, Pattern Search Method	8
Unit V	**Conjugate Direction Method**, Steepest Descent Method, Newton's Method, Conjugate Gradient Method, Davidon-Fletcher-Powell Method	5
Unit VI	**Introduction to Constrained Optimization**: Interior Penalty Function Method, Exterior Penalty function Method	6

Tutorial

Eight assignments based on syllabus

Course outcome

1. Students will able to apply knowledge of optimization in industry as well as research fields
2. Students will able to understand various software tools

3 Students will able to recognize and formulate problems that arise in engineering in terms of optimization problems
4 Students will able to get experience of how such problems are solved
5 Students will able to do programming

Text Books

1 Operation Research-An introduction by Hamdy A Taha. Prentice Hall
2 Introduction To Management Science, Anderson, Thomson Learning, 11Edn
3 Operation Research Applications and Algorithms, Winston, Thomson Learning, 4Edn.
4 Introduction to Operation Research by Hiller/Lieberman. McGraw Hill.
5 Optimization for Engine ring Design by Deb & Kalyan way.
6 Optimization Theory and application by S. S Rao.

References

1 Introduction to Operations Research, Hillier and Lieberman, Tata McGraw Hill
2 Quantitative techniques in Management by N D Vohra, 4/e, Tata McGraw Hill
3 Deb K (2004). Optimization for Engineering Design: Algorithms and Examples, Prentice Hall of India.
4 Rao S (1996). Engineering optimization, Theory and Practice, New Age International Publishers
5 Ravindran A, Ragsdell K and Reklaitis G (2006). Engineering Optimization: Methods and Applications, 2nd edition, John Wiley and Sons Inc.

Useful Links

1 http://mech.iitm.ac.in
2 www.nptel.ac.in/course/105108127
3 http://web.stanford.edu/~boyd/cvxbook/bv_cvxslides
4 www.brad.ac.uk/staff/vtoropov/burgeon/thesis_sameh/chap5

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 202: Advanced Casting Technology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Have a basic understanding of foundry practices and processes
2. It is the intent to serve as an introduction to the major concepts associated with metal casting
3. Design aspects of casting, Riser and gating system
4. Advanced melting techniques and control of casting quality
5. Mechanization and Modernization of foundry. Robotic applications

Course Contents		**Hours**
Unit I	**Introduction**: Comparison of casting technology with other metal processing technologies, merits and limitations, Comparison of casting manufacturing in India with that in other countries, specifications of composition and purity of cast metals.	5
Unit II	**Casting Design & Pattern / Die Making**: Review of conventional method of casting and pattern design, pattern and die design considerations, Computer aided casting component design, Computer aided design and manufacturing of patterns and dies, advanced materials for pattern sand dies - selection and applications, Use of simulation software for casting methoding and metal flow simulation, rapid pattern making **Resin Coated Sands & Processing**: Properties of shell sand, no-bake sand systems, CO_2 sand, cold box sand, their comparison, equipment for sand processing, developments in sand mullers and sand plants, sand reclamation - cost and environmental issues, types of reclamation methods,	8
Unit III	**Sand Molding & Core Making Practices**: High pressure molding technology, flaskless molding technology, magnetic molding, Core shooters used in shell core making and cold box process, Mold and core washes / coats – types, applications, selection and significance, Use of ceramic components and filters, their selection and significance **Permanent Mold & Special Casting Techniques:** Process parameters for Die casting-gravity, pressure and low pressure, Centrifugal casting, Vacuum casting, Investment casting, Squeeze casting; Advantages, limitations and applications.	8
Unit IV	**Melting Practices**: Developments in melting practices with reference to energy saving, scale of production, homogeneity of melt, handling and dispensing of molten metal, automated pouring equipment, use of robots for metal pouring, Furnaces- types and selection criteria, lining Materials. **Melting technology**: Melting technologies for steels, grey C.I., S.G. iron and compacted graphite iron, Al-Si alloys, Magnesium and Titanium based alloys; Inoculation, modification, de-oxidation, de-gassing, grain refinement treatments for various alloys, advanced methods for chemical analysis for metal compositions and temperature measurement	6

Unit V **Post processing of Castings**: Fettling and shot basting techniques, salvaging of defective castings, heat treatment for ferrous and non-ferrous cast alloys, protective coating for castings
Quality & Productivity: Casting defects and their classification, rejection analysis, remedial measures; instrumentation, mechanization and automation, Safety aspects in foundries, Environmental issues and regulations — 6

Unit VI **Management Information systems for Foundries**: Techniques for improvement in productivity, Total Preventive Maintenance, Just-In-Time production, 'Five S' for foundries; Costing of castings, QS standards for foundries, Information systems for inland and global
customer development — 6

Tutorial

1. Sand testing exercises for properties of raw sand, prepared sand such as strength, permeability and gas evaluation
2. Chemical analysis and microstructure study of cast alloys- Steels, Grey C.I., S.G. Iron, Al-Si alloys
3. Solid Modeling and optimization of casting methoding by use of suitable simulation. Software. –Minimum two components (One ferrous and one non-ferrous)
4. Industrial visits (minimum two) for studying molding, core making and melting technologies and submission of visit report.

Course outcome (CO):

1. Students will able to design pattern and dies
2. Students are able to select material for patterns, special sands for casting
3. Students are able to control quality of casting
4. Students are able to work on casting simulation software
5. Students are able to apply management information systems

Text Books

1. Principles of Metal Castings - Heine, Loper and Rosenthal (TMH)
2. Principles of Foundry Technology - P.L. Jain (TMH)
3. IIF - Foundry Journal
4. Advanced Pattern Making – Cox I.L. (The Technical Press, London.)
5. ASM Handbook – Vol. 15 Castings
6. Metal Castings – Principles & Practice - T.V. Ramanna Rao. (New Age International Pvt. Ltd. Publishers.)

References

1. AFS and Control hand book – AFS.
2. Mechanization of Foundry Shops – Machine Construction - P.N. Aeksenov (MIR)
3. Fundamentals of Metal Casting Technology - P.C. Mukherjee (Oxford, IBH)
4. Foundry Engineering – Taylor, Fleming & Wulff (John Wiley)
5. The Foseco Foundryman's Handbook, -Foseco, CBS Publishers & Distributors
6. The New Metallurgy of Cast Metals Castings – Campbell, CBS Publishers & Distributors
7. Fundamentals of Metal Casting – Flinn, Addison Wesley

Useful Links

1. www.ifam.fraunhofer.de/.../casting _technology/casting _technology
2. www.sim**tech**.a-star.edu.sg/.../pe _metal _initiative advanced _casting
3. www.castingstechnology.com/public/documents
4. me.emu.edu.tr/me364/2

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 203: Production & Operation Management

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To understand the role of operations management in the overall business strategy of the firm
2. To identify and evaluate the key factors and the interdependence of these factors in the design of effective operating systems
3. To identify and evaluate a range of tools appropriate for analysis of operating systems of the firm
4. To identify and evaluate comparative approaches to operations management in a global context
5. To understand the application of operations management policies and techniques to the service sector as well as manufacturing firms

Course Contents		**Hours**
Unit I	**Introduction**: Relation between production and operations and other functions, products and services, impact of information technology on productions and operations management, Business strategy- competitive priorities, developing operations strategy, productivity and competitiveness. **Product and Service Design**: Traditional and concurrent product design, design for manufacture, service, assembly, Design of services, types of services, Quality of design, costs of quality	7
Unit II	**Forecasting Models**: Classification, simple and weighted moving average method, exponential smoothening methods: additive model, trends and seasonality model, mixed model, Regression (linear and multiple) models, causal model, measures of forecasting accuracy, reliability of forecasts	6
Unit III	**Aggregate Production Planning**: Production planning strategies, aggregate production planning model, chase demand and level workforce strategies, and techniques- trial and error, linear programming, transportation model, dynamic programming, Master production schedule, Materials requirement planning - structure and application; Capacity planning- measures and methods to generate capacity, Aggregate planning for services- yield management	6
Unit IV	**Operations Scheduling**: Approaches to scheduling – infinite and finite loading, forward or backward scheduling, Assignment model for assigning jobs to work centers, dispatching rules for scheduling n jobs on one machine, composite rules, scheduling with Johnson's rule – n jobs-2 stations with same and different sequence, 2 jobs-n stations (graphical method), preparation of Gantt's chart, job shop scheduling, open shop scheduling, dynamic scheduling in flexible manufacturing systems, employee scheduling for service	7

Unit V	**Independent Demand Inventory Management**: Classification, EOQ models, order timing decisions, Safety Stock and reorder level decisions. Order quantity and reorder point, Continuous review systems, periodic review systems, selective inventory control - ABC analysis, Multi-item and Coordinated Replenishment Models- Spare parts and maintenance inventory models, **Inventory models with probabilistic demands**: Single period discrete probabilistic demand model, multiple period probabilistic models	8
Unit VI	**Theory of constraints**: Optimized Production Technology, Drum-rope-buffer models, Constant-WIP (CONWIP) models, Planning and Control of JIT Systems	5

Tutorial

1. Two assignments on demand forecasting of products using different models.
2. One exercise on aggregate production planning and Master Production Schedule.
3. One exercise on MRP System considering a small number of products (3-4) consisting of 4-5 components each and their manufacturing and ordering lead times.
4. Exercises on various EOQ models.
5. Exercises on probabilistic inventory models.

Course outcomes (CO)

1. Students will able to identify and evaluate the key factors and the interdependence of these factors in the design of effective operating systems
2. Students will able to analysis of operating systems of the firm
3. Students will able to forecast the production using different models
4. Students will able to know importance of information technology in operational management
5. Students will able to do production planning and operations scheduling

Text Books

1. R. B. Khanna, (2007), Production & Operations Management, PHI
2. Martin K. Starr, (2007), Production & Operations Management, India Edition, Cengage Learning
3. Dr. K.C. Arora, (2009), Production & Operations Management, University Science Press (Laxmi Publications Pvt. Ltd.)
4. Edward S. Buffa & Rakesh K. Sarin, (2010), Modern Production / Operations Management, 8/e, Wiley India Pvt. Ltd.
5. Joseph S. Martinich, (2010), Production & Operations Management- An Applied Modern Approach, Wiley India Pvt. Ltd.

References

1. Everett E. Adam Jr, & Ronald J. Ebert, Production & Operations Management
2. Jay Heizer, Barry Render & Jagdeesh Rajshekhar, (2009), Operations Management, 9/e, Pearson Education
3. Lee J. Krajewski & Larry P Ritzman, Operations Management- Strategy & Analysis, 6/e, Pearson Education
4. Inventory management and Production Planning and Scheduling by E Silver, D Pyke and R Peterson, Wiley India
5. R Tersine, Principles of Inventory and Materials Management, Pearson Education

Useful Links

1. www.newagepublishers.com/samplechapter/001233
2. elibrary.kiu.ac.ug:8080/.../Production
3. eiilmuniversity.ac.in/.../Management/Productions _&_ Operations
4. www.nitc.ac.in/.../Production Management

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 214: Elective III - Computer Aided Engineering (CAE)

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 Understand the basic steps for solid modeling.
2 Understand the basic concept of feature-based, parametric, and solid modeling.
3 Be able to construct 3-D solid models, 2-D drawing, assembly and sub-assembly structure.
4 Be able to generate 2-D and 3-D models for finite element analysis.
5 Understand the basic concepts of modeling for analysis and manufacturability.

Course Contents		**Hours**
Unit I	Introduction to solid modeling, Concepts of 3-D modeling.	6
Unit II	Model structure Engineering drawing. Fundamentals of assembly and sub-assembly.	6
Unit III	Parametric modeling, Advanced feature-based design	8
Unit IV	Fundamentals of modeling for finite element analysis, Analysis methods.	8
Unit V	Design creativity, Design for manufacturability.	6
Unit VI	Real-world problems: critiques, analysis, and improvements.	6
Tutorial	Eight assignments based on syllabus	

Course outcomes (CO)

1 Students will able to do solid modeling
2 Student will able to construct 3-D solid models, 2-D drawing, and assembly and sub-assembly structure.
3 Student will able to generate 2-D and 3-D models for finite element analysis.
4 Student will able to use creative knowledge in modeling
5 Student will able to analyze real-world problems

Text Books

1 R. Toogood. Pro-Engineer WildFire 4.0. Schroff Development Corporation. (2007). ISBN-13: 978-1585034154

References

1 Computer Aided Engineering Design by Saxena, Anupam, Sahay, Birendra, Publisher Springer Netherlands
2 Fundamentals of Computer-Aided Engineering by Benny Raphael (Author), Ian F. C. Smith, Publisher: Wiley; 1 edition
3 Product Design Modeling using CAD/CAE: The Computer Aided Engineering Design Series by Kuang-Hua Chang, Publisher: Academic Press; 1 edition

Additional information

Introduction to the use of modern computational tools used for design and analysis. Primary focus is on product design with solid modeling and finite-element analysis. Software used is representative of that found in industry.
Topics such as 2-D and 3-D drawing, tolerance specification, and FEA
validation Are also covered.

Useful links

1 atilim.edu.tr/.../MECE
2 www.dtic.mil/dtic/tr/fulltext/u2/a280966.
3 www.ip-zev.gr/files/teaching/T2_CAD-CAM
4 www.qrg.northwestern.edu/papers/files/icae(searchable)

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 224: Elective III - Noise and Vibration

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 Introduce students to the sources of noise and the noise issues environmental engineer's face
2 Introduce applications of noise and vibration control to students
3 Introduce students how to mathematical modeling the vibration and acoustics system
4 Enable students to understand of measurements and numerical simulation of vibration and acoustics problems

Course Contents **Hours**

Unit I **Physics of Noise and Vibration**

Properties of Sound, Propagation of sound by longitudinal wave motion, Relationship between frequency, wavelength and velocity, Velocity of sound - dependence on temperature and bulk modulus, Infra sound and ultra sound - definitions and common sources, Simple harmonic motion

Definitions and Measurements Units

Noise, Sound pressure and sound pressure level. Sound intensity and intensity level, reference values. Range of sound pressures in audio range. Definition and application of decibel scale. Relationship between sound pressure and sound power level. Time varying sources, definition and use of equivalent continuous sound level. Characteristics of impulse and impact noise. Equivalent continuous sound level and usage. Understanding of weighting scales A and C, comparison with linear levels and awareness of other weighting scales. Frequency characteristics of sound. Octave, third octave and narrow band spectra. Summation of sound pressure levels and calculation of sound power levels — 8

Definitions and Measurements Units

Vibration, Units of measurement, understanding of acceleration amplitude. Velocity amplitude and displacement amplitude. Choice of measurement parameters, dynamic range and frequency information required. Relationship and implications of mass and stiffness and damping, natural frequency and static deflection.

Unit II Single degree of freedom systems, two degree of freedom systems spring coupled, mass coupled, vibration absorbers, and vibration isolation

Multi degree of freedom systems

Lagrange's equation, close couples and far coupled systems, dunker ley's approximation method, rayleigh method, matrix method, matrix iteration, orthogonality principle, orthogonality, expansion theorem and modal analysis, stodola method, holzer method, galerkin method, rayleigh- ritz method, myklested – prohl method for far coupled systems, transfer matrix method — 8

Unit III **Experimental methods in vibration analysis**

vibration instruments, vibration exciters, transducers and measurement devices, 5
analyzers, vibration tests:- free and forced vibration tests

Unit IV **Vibration of continuous systems**

Transverse, flexural, torsional vibration of beams, Timoshenko beam, Hamilton principle, vibration of plates, collocation method, myklested – prohl method. 7

Transient vibrations

Duhamel's integral, method of step input, phase plane method, method of Laplace transformation, drop test spectra by Laplace transformations

Unit V **Nonlinear vibrations :**

Nonlinear vibrations and superposition principle, examples of nonlinear vibrations, method of dealing with nonlinear vibrations, phase plane trajectories, method of direct integration, perturbation method, iteration method, Fourier series. 6

Unit VI **Acoustics**

Physical and mathematical representations of acoustic waves and vibrating systems, mathematical techniques for determining solutions to equations of motion. 1D and 3D acoustic waves and units of measurement, time and frequency domain statistics for acoustic signals and the foundations of waves and signals using a mathematical approach.

Digital representation of audio signals, the decomposition of signals in frequency analysis, the manipulation of signals using digital filters, design of filters and the measurement of audio systems using digital systems, assessments of environmental noise, including: identifying and interpreting the requirements of appropriate local, national and international, appropriate noise control options for realistic environmental and industrial noise scenarios, justification for their selections. 5

Tutorial

Eight assignment based on syllabus

Course outcomes (CO)

1 Students will able to identify factors which are responsible for noise and vibration
2 Students will able to design assembly which will be having low noise and vibrations
3 Students will able to handle noise and vibration signal measurement systems
4 Students will able to do mathematical modeling the vibration and acoustics system
5 Students will able to understand environmental issues related to noise and vibrations

Text Books

1 M L Munjal (Indian Institute of Science, India), Noise and Vibration Control, World Scientific Publishing Company
2 Singiresu S .Rao - "Mechanical Vibrations" - Pearson Education, ISBM –81-297- 0179-0 - 2004.
3 Colin Hansen, Scott Snyder, Active Control of Noise and Vibration, Second Edition, CRC Press
4 Handbook of Noise and Vibration Control Malcolm J. Crocker , Wiley

References

1 Michael Peter Norton, D. G. Karczub, Fundamentals of Noise and Vibration Analysis for Engineers, Cambridge University Press
2 Bies, D. and Hansen, C. "Engineering Noise Control - Theory and Practice", Taylor and Francis
3 Fundamentals of Acoustics, Kinsler L. E. et al, Wiley
4 Industrial Noise Control Fundamentals and applications, Lewis H. Bell, Douglas H. Bell, Marcel Dekker, Inc

Useful Links

1 www.aticourses.com/sampler/Vibration&Noise Control
2 ftp://ftp.mecanica.ufu.br/.../(Wiley) **Noise** Vibration
3 www.diva-portal.org/smash/get/diva2:837892/FULLTEXT01

4 www.cdc.gov/niosh/mining/userfiles/.../08-yantekpracticalcontrols

Mapping of CO and PO

	Program Outcomes													
	a	**b**	**c**	**d**	**e**	**F**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 234: Elective III -Fabrication Engineering &Welding Technology

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 To understand preparatory operations
2 To learn different types of fabrication machinery used in industry
3 To understand the aspects of welding
4 To learn advanced welding processes used in industry
5 Study of inspection and planning

Course Contents		**Hours**
Unit I	**Preparatory Operations** – Different metal cutting methods used in fabrication, Advantages and limitations, straightening methods, bending on roll bending machine, press, press brake. Different edge preparation and cleaning methods, Precautions in preparatory operations for stainless steel and aluminum, fabrication characteristics of metals and composites.	6
Unit II	**Fabrication Machinery** – Welding machines, three roll bending presses, press brakes, shearing machine, plasma arc cutting machine, Different types of hand grinders, loading, unloading equipments, material handling equipments	7
Unit III	**Welding Metallurgy**, controlling weld cracks, weld cracks, weld joint design, welding process selection, welded connections, welding fixtures, distortion control tools, solidification of weld, heat affected zone, automation in welding	6
Unit IV	**Weld Quality and Defects**, failure of welds, inspection and testing of welds, I.S. code for welding and weldmnts, destructive tests for welds, microstructure for weld joints, welding defects and remedies	6
Unit V	**Modern welding processes** like EBW, LBW, diffusion bonding, ultra sonic welding, pulsed current welding processes, and friction welding. Welding of ceramics, plastics and composites	7
Unit VI	**Stage inspection** in fabrication process, planning for fabrication jobs	7

Tutorial

Eight assignment based on syllabus

Course Outcomes (CO)

1 Students will able to perform different metal profile by selection of different cutting methods
2 Students will able to get required component by different fabrication techniques
3 Students will able to analyze welding defects which would happen during welding
4 Students will able to perform latest welding methods

5 Students will able to detect defective components manufactured by fabrication methods

Text Books

1 Richard Little, "Welding and Welding Technology." TMH
2 U. S. Steel Corporation, "Fabrication of Stainless Steel."
3 ASTME, "Fundamentals of Tool Engineering Design", PHI Publication.
4 Schwartz M.M., "Metal Joining Manual", McGraw Hill, NY 1979.

References

1 Begman, "Manufacturing Processes
2 Schwartz M.M., "Metal Joining Manual", McGraw Hill, NY 1979
3 Cnnur L.P., "Welding Handbook Vol I & II", American Welding Society, 1989.
4 Hauldcraft P.T, "Welding Process Technology", Cambridge University Press, 1985

Useful Links

1 weldinginst.yolasite.com/.../Fabrication Welding
2 www.sciencedirect.com/science/book/9780750666916
3 unesdoc.unesco.org/images/0016/001613/161340e
4 www.ewf.be/media/.../doc_55_welding_fabrication_standards_cracked

Mapping of Course Outcomes to Program Outcomes

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 244: Elective III - Reliability Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To apply engineering knowledge and specialist techniques to prevent or to reduce the likelihood or frequency of failure
2. To provide the practicing Systems Engineer with fundamental understanding of reliability and maintainability engineering, with emphasis on determining reliability at the system level.
3. To apply methods for estimating the likely reliability of new designs, and for analysis of reliability data.
4. To understand and apply probabilistic and stochastic representations of reliability and failure
5. To understand how disciplined maintenance and designing for maintainability can accomplish our objectives and provide a cost effect means to offset the lack of resources to design 100% reliable systems

Course Contents		**Hours**
Unit I Definitions:	Causes and types of failures. Reliability expressions for constant, increasing and decreasing hazard rates **Data Analysis**: Probability plots for various distributions (exponential, Weibull, Normaland Gamma)	6
Unit II	**Series, parallel, series-parallel, standby and k-out-of-m modeling.** **System reliability evaluation techniques**, including methods of bounds, decomposition and transformation techniques	7
Unit III	**Single and Multiple variable inversion techniques** for minimizing system reliability expression. **Analysis of dependent failures:** Reliability computations using similar and dissimilar stress-strength distributions (exponential, Weibull, normal and Gamma).	6
Unit IV	**Time dependent stress-strength distributions:** fatigue failures, Recent trends in reliability evaluation techniques **Maintained systems** and various definitions associated with them. Type of Maintenance. Maintainability analysis	6
Unit V	**Markov Models** for reliability, availability and MTTF computations. Renewal Theory Approach. Maintainability design considerations, Life Cycle Costs **Life/Durability Tests** of devices/ components, environmental testing of components/circuits/ equipments, vibration and endurance tests.	7
Unit VI	**Study of degradation characteristics**, failure rates of components/ devices under environmental factors Accelerated testing, parameter estimation, accelerated testing of devices and calculation of MTTF	7
Tutorial	Eight assignment based on the above syllabus	

Course Outcomes (CO)

1 Students will able to prevent the likelihood or frequency of failure
2 Students will able to work as a Systems Engineer with fundamental understanding of reliability
3 Students will able to do reliability of new designs, and for analysis of reliability data.
4 Students will able to execute disciplined maintenance to offset the lack of resources to design 100% reliable systems
5 Students will able to apply probabilistic and stochastic representations of reliability and failure

Text Books

1 Reliability Engineering, E Balgurusamy, Tata McGraw Hill
2 Bikas Badhury & S. K. Basu, "Tero Technology: Reliability Engineering and Maintenance Management", Asian Books, 2003
3 Seichi Nakajima, "Total Productive Maintenance", Productivity Press, 1993
4 Sushil Kumar Srivastava, Maintenance Engineering and Management, S. Chand
5 Mechanical Reliability Engineering by ADS Carter, Mac milan

References

1 Kumamoto, H., Henley, E., 1996. Probabilistic risk assessment and management for engineers and scientists, 2nd Edition. IEEE Press.
2 Bahr, N., 1997. System safety engineering and risk assessment- a practical approach. Taylor & Francis, Washington DC.
3 Henley, E., Kumamoto, H., 1981. Reliability engineering and risk assessment. Prentice-Hall Inc, New Jersey
4 Andrew K. S. Jardine & Albert H. C. Tsang, "Maintenance, Replacement and Reliability", Taylor and Francis, 2006
5 Reliability Evaluation of Engineering Systems by Roy Billington and R.N. Allen, Pitman

Useful Links

1 www2.warwick.ac.uk/fac/sci/wmg/.../section_7a_reliability_notes.
2 https://www.palisade.com/.../pdf/Engineering Reliability Concepts
3 www.nptel.ac.in/downloads/105108128/
4 https://hal.inria.fr/.../PDF/RELIABILITY_ENGINEERING_OLD_PROB

Mapping of CO and PO

	Program Outcomes													
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 215: Elective IV - Industrial Automation and Robotics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Introduction to Robotics & Automation and applications
2. Classify industrial robots by kinematic structure, work envelope, control system and actuation
3. Understand the difference in construction & application of various sensors used in robotic & automation systems
4. Examine common robotic and automated systems components such as actuators, power transmission systems and grippers
5. Mathematically analyze planar & simple spatial robotic systems for position control

Course Contents		**Hours**
Unit I	**Introduction:** Automated manufacturing systems, fixed /programmable /flexible automation, need; Basic elements of automated systems- power, program and control; Advanced automation functions, Levels of automation; Industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Low cost automation, Economic and social aspects of automation.	6
Unit II	**Transfer Lines:** Fundamentals, Configurations, Transfer mechanisms, storage buffers, control, applications; Analysis of transfer lines without and with storage buffers	6
Unit III	**Assembly Automation:** Types and configurations, Parts delivery at workstations- Various vibratory and non-vibratory devices for feeding and orientation, Calculations of feeding rates, Cycle time for single station assembly machines and partially automated systems; Product design for automated assembly.	7
Unit IV	**Fundamentals of Industrial Robots:** Specifications and Characteristics, Basic components, configurations, Criteria for selection, various industrial applications	6
Unit V	**Robotic Control Systems:** Drives, Robot Motions, Actuators, Power transmission systems, Robot controllers, Dynamic properties of robots- stability, control resolution, spatial resolution, accuracy, repeatability, compliance.	7
Unit VI	**Robotic End Effectors and Sensors:** Transducers and sensors- sensors in robotics and their classification, Touch (Tactile) sensors, proximity and range sensors, force and torque sensing, End Effectors- Types, grippers, Various process tools as end effectors; Robot-End effector interface, Active and passive compliance, Gripper selection and design. **Robot Programming:** Lead through method, Robot program as a path in space, Methods of defining positions in space, Motion interpolation, branching; Textual robot programming languages	7
Tutorial	Eight assignment including analysis, modeling, simulation and programming of industrial robotic systems	

Course Outcome (CO)

1 Students will able to design robotics and automation for specific applications
2 Students will able to use different robotic mechanisms
3 Student will able to construct different sensors in robots
4 Student will able to select different robots depending upon different specifications
5 Students will able to do robot programming

Text Books

1 Groover, M.P., (2004), "Automation, Production Systems & Computer Integrated Manufacturing" 2/e, (Pearson Edu.)
2 Pessen, David W.(1990), "Industrial Automation, Circuit Design & Components", (John Wiley& Sons, Singapore)
3 Morris, S. Brian (1994), "Automated Manufacturing Systems", (McGraw Hill)
4 Groover, M.P.; Weiss, M.; Nagel, R.N. & Odrey, N.G. "Industrial Robotics, Technology, Programming & Applications", (McGraw Hill Intl. Ed.)
5 5. Fu, K.S.; Gonzalez, R.C. & Lee, C.S.G. "Robotics-Control, Sensing, Vision and Intelligence",(McGraw Hill Intl. Ed.)

References

1 Keramas, James G. (1998), "Robot Technology Fundamentals".
2 Noff, Shimon Y. "Handbook of Robotics", (John Wiley & Sons)
3 8.Niku, Saeed B. (2002), "Introduction to Robotics, Analysis, Systems & Applications" ,(Prentice Hall of India)
4 Koren, Yoram "Robotics for Engineers", (McGraw Hill)
5 Schilling, Robert J.(2004), "Fundamentals of Robotics, Analysis & Control", (Prentice Hall of India)
6 Robotics: Modeling, Planning & Control, B. Siciliano, L. Sciavicco, L. Villani, G. Oriolo (2011), Springer

Useful Links

1 literature.rockwellautomation.com/idc/groups/.../gmsa-br002_-en-p
2 www.zums.ac.ir/files/.../Robotics/Automation *and Robotics*
3 www.diag.uniroma1.it/~deluca/rob1_en/01_IndustrialRobots
4 www.**nptel**.ac.in/courses/.../**pdf**/L-01(SM)(IA&C)%20((EE)**NPTEL**).

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 225: Elective IV - Project Management

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. Utilize the use of a structured approach for each and every unique project undertaken including utilizing project management concepts, tools, and techniques.
2. Increase awareness of and strengthen skills in applying participatory methods to project/ program management
3. Understand the project management lifecycle and be knowledgeable on the various phases from project initiation through closure.
4. Develop detailed project plan to include: Defining a project's scope and tasks, estimating task resource needs, assessing project risk and response strategies, a communications plan, and more.
5. Understand the critical role an strong project manager plays in project success

Course Contents		**Hours**
Unit I	Introduction: Foundations of Project Management, Project Life Cycle, Project Environment, Project Selection, Project Proposal, Project Scope, Work Breakdown Structure.	5
Unit II	Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Assumptions in PERT Modeling, Time-cost Trade-offs, Linear Programming and Network Flow Formulations	8
Unit III	Network analysis: Shortest path method, minimal spanning tree, Floyd and Dijkastra algorithm	6
Unit IV	PERT/COST Accounting, Scheduling with limited resources, Resource Planning, Resource Allocation, Project Schedule Compression, Crashing	6
Unit V	Project Scheduling Software, Precedence Diagrams, Decision CPM, Generalized Activity Networks, GERT	7
Unit VI	Estimation of Project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project Management	7

Tutorial

Eight assignment based on consisting of quantitative treatment to industrial problems

Course Outcomes (CO)

1. Students will able to utilize the use of a structured approach for each and every unique project undertaken including utilizing project management concepts, tools, and techniques.
2. Students will able to apply participatory methods to project management
3. Students will able to do network scheduling and network planning
4. Students will able to manage lifecycle on the various phases from project initiation through

closure

5 Students will able to do estimation of project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project Management

Text Books

1 Meredith & Mantel, Project Management: A Managerial Approach, 3rd edition, John Wiley & Sons, Inc, 1995

2 Verzuh, Eric. The Fast Forward MBA in Project Management. Published by John Wiley and Sons

3 Jack Meredith, Samuel J. Mantel Jr. "Project Management- A Managerial Approach" John Wiley and Sons

4 John M Nicholas "Project Management For Business And Technology" Prentice Hall Of India Pvt Ltd

5 James P Lewis " Project Planning ,Scheduling And Control" Tata Mcgraw-Hill Publishing Co Ltd

References

1 Project Management – A Managerial Approach, by Jack R. Meredith, and Samuel J. Mantel Jr., John Wiley and Sons, 2006

2 Project Management – A Systems Approach to Planning, Scheduling and Controlling, by Harold Kerzner, John Wiley and Sons, 2006

3 Introduction to Operations Research, Hillier and Lieberman, Tata McGraw Hill

4 Clifford Gray, Erik Larson, Project Management: The Managerial Process (McGraw-Hill International Editions: Management & Organization Series), 2003

5 Project Management Body of Knowledge, 5th Edition. Published by Project Management Institute (PMI)

Useful Links

1 www.entrepreneur.com/downloads/.../project management _made_ easy.

2 www.saylor.org/.../**Project Management** From Simple

3 ga-sps.org/...project-management.../Introduction Project

4 www.usbr.gov/excellence/Finals/FinalIntroPM.

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 235: Plastic Process & Die Design

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1 To provide students with an appreciation of problems and perspectives in environmental, life cycle and recycling aspects of plastics use.
2 To evaluate usefulness and drawbacks of plastics data sheets.
3 Design and development of moulds, dies and plastic products
4 To understand quality control and standardization of plastic materials and products
5 Application development in the area of plastics

Course Contents		**Hours**
Unit I	**Plastic materials** Classification of plastic materials, their physical and mechanical properties, selection of plastics for various applications, advantages and limitations of using plastics.	6
Unit II	**Melt Processing Techniques:** Polymer processing techniques such as extrusion, compression and transfer molding. Injection molding, blow molding, thermoforming, rotational molding, calendaring, Bag molding reaction molding. Classification of polymer processing operations. Simple model Flows for analyzing processing operations with examples.	7
Unit III	**Constructional Features Molds:** constructional features of core and cavity plates, mold size and strength, cavity material, and fabrication, mold placement, constructional features and layout of runners and gates.	6
Unit IV	**Product Design of Molded Products:** Various considerations such as wall thickness, fillets and radii, ribs, under, cuts, drafts, holes, threads, inserts parting lines, etc. surface treatment mould design for avoiding warpage. Standards for Tolerances on moulded articles	6
Unit V	**Design of Molds for Plastic Processing** Methodical mold design, determination of economical number of cavities, temperature control of injection molds, calculation of mold opening force and ejection force. Detail design of cooling system, ejection system and gating system. Molding thermoplastics, thermosets, expandable polystyrene, foamed engineering plastics, molds for reaction injection molding	7
Unit VI	**Computer Applications in Plastic Molding** Use of various software packages for mold flow analysis, optimum gate location and defect analysis, design of component for balanced flow, optimization of process parameters of plastic molding.	7
Tutorial	Eight assignment based on consisting of quantitative treatment to industrial problems	

Course Outcomes (CO)

1 Students will able to know problems and perspectives in environmental, life cycle and recycling aspects of plastics use.
2 Students will able to execute software packages for mold flow analysis, optimum gate location and defect analysis, design of component for balanced flow, optimization of process parameters of plastic molding
3 Students will able to design moulds, dies for plastic products
4 Students will able to work on different plastic processing techniques such as extrusion, compression etc.
5 Students will able to do quality control and standardization of plastic materials and products

Text Books

1 A.W. Birley, B. Howarth, Hana, "Mechanics of plastics processing properties
2 J.E. Mark, R. West, (1992), "Inorganic Polymers", H.P. Alocock, Prentice Hall,
3 Fried, "Poly. Science and Technology", Prentice Hall
4 Frados, "Plastic Engg. Hand Book
5 Patton , "Plastic Technology

References

1 Glanill, "Plastic Engg. Data Book
2 Charles Harper, "Handbook of Plastics Technologies", McGraw-Hill.
3 RJW Pie, (1989), Mould& Die Design, 4/e, –Longman
4 Injection Molding Handbook- Tim A. Osswald, Lih-Sheng Turng, Paul J. Gramann, Hanser Verlag, 2008

Useful Links

1 www.cipet.gov.in/publications/.../plastics mould design text book
2 www.ielm.ust.hk/dfaculty/ajay/courses/ieem215/lecs/6_plastics
3 faculty.ksu.edu.sa/Othman /CHE498/Processing Plastics
4 web.mit.edu/2.810/www/lecture/Injection Moulding

Mapping of CO and PO

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mechanical-Production Engineering
PE 245: Automatic Control Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To teach the fundamental concepts of Control systems and mathematical modeling of the system
2. To study the concept of time response and frequency response of the system
3. To teach the basics of stability analysis of the system
4. To give the basic knowledge for more advanced control courses, such as state-space control techniques, etc.
5. To learn how to model mechanical, electrical, and electromechanical systems as differential equations and transfer functions

Course Contents		**Hours**
Unit I	**Introduction to Automatic Control Systems:-**Basic definition, Structure of a feedback systems, closed loop and open loop control systems. Laplace Transformation, Building blocks and transfer functions of mechanical, electrical, thermal and hydraulic systems. Mathematical models of physical systems, control systems components. Systems with dead time, control hardware and their models, Electro-hydraulic valves, hydraulic servomotors, synchros, LVDT, electro-pneumatic valves, pneumatic actuators.	6
Unit II	**Basic characteristic of feedback control systems:-**Stability, steady state accuracy, transient accuracy, disturbance rejection, insensitive and robustness, Basic models of feedback control systems:-Proportional, integral, derivative and PID, feed forward and multi loop control configurations, stability, concept of relative stability.	7
Unit III	**Root locus and frequency response methods**, stability in frequency domain, frequency domain methods of design, compensation and their realization in time and frequency domain, improving system performance	6
Unit IV	**Design of Lead lag compensators**, Op-Amp based and digital implementation of compensators, Tuning of process controllers	6
Unit V	**Introduction to design, sample data control systems**, stable variable analysis and design, optimal control systems	7
Unit VI	**Introduction to non linear control systems**, discrete time systems and Z-Transformation methods, Microprocessor based digital control, State space analysis, Optimal and adaptive control systems.	7

Tutorial

Assignments consist of four design/control problems solved using MATLAB and three assignments based on the above topics. Additional exercises using Bond Graphs for system modeling are desirable.

Course Outcome (CO)

1 Students will able to design Control systems and mathematical modeling of the system
2 Students will able to design control systems by advanced control courses, such as state-space control techniques, etc.
3 Students will able to utilize MATLAB for designing control systems
4 Students will able to design Lead lag compensators
5 Students will able to do stability analysis of the system

Text Books

1 F.H. Raven, "Automatic Control Engineering", Third edition, McGraw Hill, 1983.
2 K. Ogata," Modern Control Engineering", PHI, Eastern Economy Edition, 1982
3 Gopal M, Digital Control and State variable Methods, Tata McGraw-Hill, New Delhi, 2003
4 B. C. Kuo, "Automatic Control Systems, Prentice Hall, New Delhi, 2002.
5 I.J. Nagrath and M. Gopal," Control System Engineering," New Age international (P) Ltd, New Delhi, 2006.
6 Richard Dorf & Robert Bishop, "Modern control system", Pearson Education, New Jersey 2005.

References

1 Schaum Series," Theory and Problems of Feedback and Control Systems". (MGH)
2 Miller R.W .,"Servo Mechanism Devices and Fundamentals"
3 Dr. N. K. Jain," Automatic Control Systems Engineering", Dhanpat Rai Publishing Company.
4 Jack Golten, Andy Verwer, "Control System Design and Simulation", McGraw Hill

Useful Links

1 www2.nuu.edu.tw/~emo/e.../Automatic Control
2 https://2k9meduettaxila.files.wordpress.com/.../automatic-control-engine
3 www.cems.uvm.edu/~gmirchan/classes/EE295/ch03
4 nptel.ac.in/video. Php subjectId=108101037

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO1	√				√	√								
CO2			√								√	√		
CO3		√											√	
CO4					√						√			√
CO5			√					√						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE 206: Laboratory Practice-II

Laboratory Scheme		**Examination Scheme**	
Practical	4 Hrs/week	**CA**	50
Total Credits	2	**ESE**	50

Course Objectives

1 To solve multi-constraint and non-linear problems by optimization technique.
2 To learn various optimization techniques.
3 To learn simulation software for casting simulation
4 To carry out chemical analysis of cast alloys
5 To get familiar with various foundry processes

Course Contents

Experiment 1 MATLAB program for non-linear model

Experiment 2 MATLAB program for multi constraint optimization

Experiment 3 MATLAB program for various optimization methods

Experiment 4 Industrial visit to foundry

Experiment 5 Use of simulation software for casting and metal flow simulation

Experiment 6 Chemical analysis and microstructure study of cast alloys- Steels, Grey C.I., S.G. Iron, Al-Si alloys

Experiment 7 Experiment based on the contents of Elective III

Experiment 8 Experiment based on the contents of Elective III

Experiment 9 Experiment based on the contents of Elective III

Experiment 10 Experiment based on the contents of Elective IV

Experiment 11 Experiment based on the contents of Elective IV

Experiment 12 Experiment based on the contents from Elective IV

List of Submission

1 Total number of Experiments 12
2 Field Visit Report

Laboratory Outcomes (LO)

1 The students will be able to prepare programs for various optimization techniques in MATLAB software.
2 The students will be able to run simulations for casting processes.
3 The students will be able to do chemical analysis of cast alloys
4 The students will be able to solve non-linear and multi-constraint problems

Mapping of Laboratory Outcomes to Program Outcomes

Laboratory Outcomes	**Program Outcomes**													
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**	**l**	**m**	**n**
1	√	√	√		√	√								
2	√		√								√	√		
3	√	√						√	√				√	
4	√				√						√			√
5	√		√					√						

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	CA	ESA
Assembling														
Testing	2	2	2				2	2	2	2	2	2	2	4
Observing	3	3	3	4	4	4	3	3	3	3	3	3	3	6
Analyzing	10	10	10	6	6	6	10	10	10	10	10	10	10	10
Interpreting	10	10	10	20	20	20	10	10	10	10	10	10	10	10
Designing														
Creating														
Deducing conclusions	20	20	20	20	20	20	20	20	20	20	20	20	20	20

Government College of Engineering, Karad
First Year M. Tech. Mechanical-Production Engineering
PE:207 Seminar I

Laboratory Scheme		**Examination Scheme**	
Practical	**2 Hrs/week**	**CA**	**50**
Total Credits	**1**	**ESE**	

Course Contents

Seminar – It should be based on the literature survey on any topic relevant to manufacturing engineering and management. It may be leading to selection of a suitable topic of dissertation.

Each student has to prepare a write up of about 25 pages. The report typed on A4 sized sheets and bound in necessary format should be submitted after approved by the guide and endorsement of Head of Department.

The student has to deliver a similar talk in front of the faculty of the department and the students. The guide based on the quality of work and preparation and understanding of the candidate shall do assessment of the seminar.

List of Submission

1 Seminar report

Government College of Engineering, Karad
Second Year M. Tech. Mechanical-Production Engineering
PE 301: Seminar II

Laboratory Scheme		**Examination Scheme**	
Practical	2Hrs/week	**CA**	50
		ESE	

Total Credits = 1

Course Contents

Seminar - II shall be based on topic of the Dissertation Work. It may include literature review, required theoretical input, study and comparison of various approaches for the proposed dissertation work. The candidate shall prepare a report of about 25 pages. The report typed on A4 sized sheets and bound in the prescribed format shall be submitted after approval by the Guide and endorsement of the Head of Department. It will be assessed for term work by the evaluation committee (*) appointed by the Head of the Department.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

List of Submission

1 Seminar report

Government College of Engineering, Karad
Second Year M. Tech. Mechanical-Production Engineering
PE 302: Dissertation Phase I

Laboratory Scheme		**Examination Scheme**	
Practical	20 Hrs/week	**CA**	100
Total Credits	10		

The dissertation work to be carried out individually commences in the Semester III and extends through Semester IV. The topic of dissertation work related should be related to the areas of Mechanical/ Production Engg. Applications. Applications of computer as a tool for conceptualization, design, analysis, optimization, manufacturing, manufacturing planning/management, quality engineering, simulation of products / processes / mechanisms / systems, experimental study, etc. are to be encouraged and preferred.

SYNOPSIS APPROVAL

The Head of the Department shall appoint a committee comprising of the Guide and two experts to review and approve the synopses.

Course Contents

It shall include the problem definition, literature survey, approaches for handling the problem, finalizing the methodology for the dissertation work and design calculations / experimental design etc. A report of the work shall be submitted at the end of Semester III after approval by the Guide and endorsement of the Head of Department. It will be assessed for term work, by the evaluation committee (*) appointed by the Head of the Department, for appropriateness, sufficiency of contents and offer suggestions if any.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

The term work under this submitted by the student shall include.

1) Work diary maintained by the student and countersigned by his guide.

2) The content of work diary shall reflect the efforts taken by candidates
for (a)Searching the suitable project work.
(b) Visits to different factories or organizations.
(c) The brief report of feasibility studies carried to come to final conclusion.
(d) Rough sketches
(e) Design calculations etc. carried by the student.

3) The student has to make a presentation in front of panel of experts in addition to guide as decided by department head.

List of Submission

1 Project/Dissertation Report

Government College of Engineering, Karad
Second Year M. Tech. Mechanical-Production Engineering
PE 401: Dissertation Phase – II

Laboratory Scheme		**Examination Scheme**	
Practical	30 Hrs/week	**CA**	100
Total Credits	20	**ESE**	200

Course Contents

The candidate shall submit the detailed report as per the synopsis approved by the university, of the dissertation work in the prescribed format after approval by the Guide and endorsement by the Head of the Department. It will be assessed for term work by the evaluation committee appointed by the Head of the Department, for completion of the proposed work.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

The dissertation submitted by the student on topic already approved by institute authorities on basis of initial synopsis submitted by the candidate, shall be according to following guide lines.

Format of dissertation report:

The dissertation work report shall be typed on A4 size bond paper. The total No. of minimum pages shall not less than 60. Figures, graphs, annexure etc be as per the requirement.

The report should be written in the standard format.

1. Title sheet
2. Certificate
3. Acknowledgement
4. List of figures, Photographs/Graphs/Tables
5. Abbreviations.
6. Abstract
7. Contents.
8. Text with usual scheme of chapters.
9. Discussion of the results and conclusions
10. Bibliography (the source of illustrative matter be acknowledged clearly at appropriate place IEEE/ASME/Elsevier Format)

List of Submission

1 Project/Dissertation Report