Government College of Engineering, Karad

(*an Autonomous Institute of Government of Maharashtra*)

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Production Engineering

Semester – I (w.e.f.: AY 2019-20)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	PE1101	Advanced Material & Manufacturing	3	-	-	3	3	15	15	10	60	100
2.	PCC	PE1102	Metal Forming Technology	3	-	-	3	3	15	15	10	60	100
3.	PEC	PE11*3	Program Elective - I	3	-	-	3	3	15	15	10	60	100
4.	PEC	PE11*4	Program Elective - II	3	-	-	3	3	15	15	10	60	100
5.	MDC	RM1105	Research Methodology	2	-	-	2	2	15	15	10	60	100
6.	PCC	PE1106	Lab Practice - I	-	-	4	4	2	-	-	25	25	50
7.	PEC	PE1107	Lab Practice - II	-	-	4	4	2	-	-	25	25	50
8.	OEC	OE11*8	Open Elective	3	-	-	3	3	15	15	10	60	100
9.	MNC	AU11*9	Audit Course - I	2	-	-	2	-	-	-	-	-	-
			Total	19	-	8	27	21	90	90	110	410	700

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

*- Program Elective / Audit Course / Open Elective (*list is provided at the end of structure*)

Government College of Engineering, Karad

(*an Autonomous Institute of Government of Maharashtra*)

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Production Engineering

Semester – II (w.e.f.: AY 2019-20)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PCC	PE1201	Advanced Casting Technology	3	-	-	3	3	15	15	10	60	100
2.	PCC	PE1202	Production & Operations Management	3	-	-	3	3	15	15	10	60	100
3.	PEC	PE12*3	Program Elective - III	3	-	-	3	3	15	15	10	60	100
4.	PEC	PE12*4	Program Elective – IV	3	-	-	3	3	15	15	10	60	100
5.	PEC	PE12*5	Program Elective - V	3	-	-	3	3	15	15	10	60	100
6.	PCC	PE1206	Lab Practice - III	-	-	4	4	2	-	-	25	25	50
7.	PEC	PE1207	Lab Practice - IV	-	-	4	4	2	-	-	25	25	50
8.	P / S/ IT	PE1208	Seminar on Pre-Dissertation work	-	-	4	4	2	-	-	50	50	100
9.	MNC	AU12*9	Audit Course - II	2	-	-	2	-	-	-	-	-	-
			Total	17	-	12	29	21	90	90	110	410	700

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

*- Program Elective / Audit Course / Open Elective (*list is provided at the end of structure*)

*-Program Elective V - Students are permitted to register online courses available on different online platforms. If student will choose classroom teaching process then only CT-I. CT-II, ESE will be conducted, otherwise grade will be accepted as given by course offering agency.

Government College of Engineering, Karad

(*an Autonomous Institute of Government of Maharashtra*)

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Production Engineering

Semester – III (w.e.f.: AY 2019-20)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	P / S / IT	PE1301	Dissertation - I	-	-	14	14	07	-	-	100	100	200
2.	PEC	PE1302 **	MOOC online course (8-12 weeks)	-	-	-	-	03	-	-	-	-	-
			Total	-	-	14	14	10	-	-	100	100	200

TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

** PE1302 is mandatory and will be decided by respective Guide in consultation with Programme Head.

Government College of Engineering, Karad

(*an Autonomous Institute of Government of Maharashtra*)

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Production Engineering

Semester – IV (w.e.f.: AY 2019-20)

Sr.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	P / S / IT	PE1401	Dissertation - II	-	-	32	32	16	-	-	100	200	300
			Total	-	-	32	32	16	-	-	100	200	300

TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance)

Government College of Engineering, Karad

(*an Autonomous Institute of Government of Maharashtra*)

Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech. course in Production Engineering

List of Program Elective Courses

Semester – I		**Semester – II**		
Program Elective - I	**Program Elective - II**	**Program Elective - III**	**Program Elective - IV**	**Program Elective – V All NPTEL Courses**
PE1113: Advanced Machine Tool Design	**PE1114:** Mathematical Modeling and Simulation	**PE1213:** Computer Aided Engi neering (CAE)	**PE1214:** Industrial Automation and Robotics	**PE1215:** Fundamentals of Surface Engineering: Mechanisms, Processes and Characterizations (Online Course)
PE1123: Advanced Tooling and Die Design	**PE1124:** MEMS & Nanotechnology	**PE1223:** Noise and Vibration	**PE1124:** Automatic Control Engineering	**PE1225:** Mechanics of machining (Online Course)
PE1133: Costing and Cost Control	**PE1134:** Supply Chain Management & Logistics	**PE1233:** Fabrication Engineering &Welding Technology	**PE1234:** Plastic Process & Die Design	**PE1235:** Processing of polymers and polymer composites (Online Course)
PE1143: Introduction to Mechanical Micro Machining	**PE1144:** Work System Design	**PE1243:** Condition Monitoring	**PE1244**: Product Life Cycle Management	**PE1245** Advanced welding and joining technologies (Online Course)
PE1153: Quality Engineering for Manufacturing (Online Course)	**PE1154:** Precision Engineering and Lean Manufacturing (Online Course)	**PE1253:** Finite Element Method in Manufacturing (Online Course)	**PE1254**Additive Manufacturing (Online Course)	**PE1255** Surface engineering and nanomaterials (Online Course)

List of Open Electives and Audit Courses

Semester - I		Semester – II
Open Electives	**Audit Course - I**	**Audit Course – II**
OE1118: Business Analytics	**AU1119:** Research Paper Writing	**AU1219:** Constitution of India
OE1128: Industrial Safety	**AU1129:** Disaster Management	**AU1229:** Pedagogy Studies
OE1138: Operations Research	**AU1139:** Sanskrit for Technical Knowledge	**AU1239:** Stress Management by Yoga
OE1148: Cost Management of Engineering Projects	**AU1149:** Value Education	**AU1249:** Personality Development through Life Enlightenment Skills
OE1158: Composite Materials		
OE1168: Waste to Energy		

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE1101: Advanced Material and Manufacturing

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	Understand the latest developments in material science and materials to cope up with requirements of industry
2.	Use special processes such as EDM, PVD, CVD etc electronic components
3.	Select materials according to its application
4.	Use non-conventional machining processes

	Course Contents	Hours
Unit 1	**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 non-ferrous alloys for modification of structure and properties.	**(06)**
Unit 2	**Modern materials-** Compositions, properties and applications of: Inter-metallics, Ni and Ti aluminides, smart materials, shape memory alloys, Metallic glass- quassi-crystals, Dielectrics, semi-conductors, conductors & super conducting materials. Magnetic and photoelectric materials, optical materials, Bio materials, micro electronic materials and nano-materials.	**(07)**
Unit 3	**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, Al_2O_3, SiC, Si_3N_4, CBN and diamond-properties, processing and applications.	**(07)**
Unit 4	**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 vapour deposition of matrix on fibers, Liquid state fabrication methods, Infiltration, squeeze casting, Rheo casting, compo casting. Applications	**(07)**
Unit 5	**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	**(07)**
Unit 6	**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.	**(06)**

Tutorials

Text Books

1.	Chawla K. K., "Composite Materials", Springer-Verlag New York Inc., 2nd ed., 2001
2.	Amitabha Ghosh & A. K. Mallik, "Manufacturing Science", Affiliated East-West Press, 2nd ed., 2010
3.	Shun-Hsyung Chang, "Advanced Materials: Physics, Mechanics and Applications", Springer Proceedings in Physics, 2014

Reference Books

1.	Kalpak Jian & Steven R. Schmid, "Manufacturing Processes for Engineering Materials", Pearson Education, 6th ed., 2018
2.	Agarwal D & Brontman L.J., "Analysis & Performance of Fibre Composites", John Willey Publications, 1990

Useful Links

1.	https://nptel.ac.in/courses/113105057/
2.	https://metals.mobil-lernen.com/en/elearning

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1102: Metal Forming Technology

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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	**(06)**
Unit 2	**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.	**(07)**
Unit 3	**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	**(06)**
Unit 4	**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.	**(06)**
Unit 5	**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. **Wire Drawing**: Introduction, wiredrawing, analysis of wiredrawing and Residual stress in wire, wiredrawing dies.	**(07)**
Unit 6	**Sheet Metal Forming**: Introduction, forming methods, shearing and blanking, bending, stretch forming, deep drawing, forming limit criteria, Defects in formed parts. **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	**(07)**

Tutorials

1.

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

Reference Books

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		

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1113: Elective I - Advanced Machine Tool Design

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	do failure analysis of mechanical comp
2.	design drive systems for tool
3.	design control systems for tool
4.	work on various tool design software by studying mechanics of tool
5.	perform on special purpose machines

	Course Contents	Hours
Unit 1	**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	**(06)**
Unit 2	**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.	**(07)**
Unit 3	**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	**(06)**
Unit 4	**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/antifriction 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.	**(07)**
Unit 5	**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	**(06)**
Unit 6	**Special Purpose Machines:** Requirement analysis, design considerations, drives, transmission and controllers, Modular design of machine tool	**(07)**

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

Reference Books

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.mech.utah.edu
2.	www.skf.com

3.	www.springer .com

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1123: Elective I - Advanced Tooling and Die Design

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	Describe tool design methods and punch and die manufacturing techniques
2.	Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature
3.	Describe the principles of clamping, drill jigs and computer aided jig design
4.	Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools
5.	Explain the principles of dies and moulds design

	Course Contents	Hours
Unit 1	**Tool design fundamentals:** Objectives of tool design, Introduction to principles of tooling in manufacturing, economics of tooling, **Tool design methods & practices:** Introduction, design procedure, statement of the problem, needs analysis – tentative design solutions, finished design, drafting and design techniques in tooling drawings, tool making practices	**(06)**
Unit 2	**Tooling materials & heat treatments:** Introduction, properties of tool materials, the selection of carbide cutting tools, use of plastic as tooling material, various heat treatments and factors affecting heat treatments	**(06)**
Unit 3	**Design of cutting tools:** Metal cutting process, mechanics and geometry of chip formation, metal cutting tools- terminology –chip formation– design for single point cutting tools, milling cutters, drills, reamers, taps, cutting tools for numerical control **Gauges and gauge design:** Fixed gauges, gauge tolerances, the selection of material for gauges.	**(06)**
Unit 4	**Design of jigs**: Basic principle of location, locating methods and devices, principles of clamping, drill jigs-definition, types, general considerations in the design of drill jigs and modern manufacturing, computer aided jig design **Design of fixtures:** Types of fixtures, vice fixtures, milling fixtures, boring fixtures, broaching fixtures, lathe fixtures, grinding fixtures, computer aided fixture design, welding fixtures, fixture design for NC machine tools.	**(07)**
Unit 5	**Design of sheet metal blanking, piercing and bending dies** Introduction to die cutting operations, power press types, cutting action in punch-die operations, die-design fundamentals, blanking and piercing die construction, types of bending dies – press capacity – spring back – knockouts – direct and indirect, ejectors, pilots, strippers and pressure pads, presswork materials	**(07)**
Unit 6	**Design of sheet metal forming and drawing dies** Forming dies, drawing dies, drawing operations, variables affecting metal flow in drawing operations, draw die inserts – draw beads ironing – punch and die manufacturing techniques Blank development for axisymmetric, rectangular and elliptic parts, Single and double action dies and draw force. **Design of moulds:** Splits in mould, split locking, two-cavity and multicavity moulds, design details of injection moulds.	**(07)**

Text Books

1.	Donaldson Cyrll, George H.LeCain and Goold V.C., "Tool Design", TMH, 36th Reprint, 2006.
2.	SME - Tool and Manufacturing Engineers Handbook, Volume 1: Machining 1,494 pages, 1983
3.	SME - Die Design Handbook, 3rd Edition 928 pages, 1990
4.	J G Nee (Managing Editor), Fundamentals of Tool Design, Sixth Edition, 2010, SME, ISBN 0-87263867-7

Reference Books

1.	Wilson F.W., "Fundamentals of Tool Design", ASTME, Prentice Hall, India, 2010.
2.	G.C. Sen and A. Bhattacharya, "Principles of Machine Tools", New Central Book Agency, Kolkata, 2009.

Useful Links

1.	
2.	

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1133: Elective I - Costing and Cost Control

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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.	**(05)**
Unit 2	**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 **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.	**(08)**
Unit 3	**Machine hour rate:** definition, constituents, direct cost, indirect cost, steps for estimation of machine hour rate for conventional machines, CNC lathe and machining center **Labour Cost** – Direct and indirect labour, Workmen classification, Definition of wages, Methods of remuneration.	**(06)**
Unit 4	**Overheads:** Elements of overheads, classification, general considerations for collection, analysis of overheads, different methods for allocation, apportionment, absorption of overheads,	**(06)**
Unit 5	**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	**(08)**
Unit 6	**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	**(06)**

Tutorials

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)

Reference Books

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

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1143: Elective I - Introduction To Mechanical Micro Machining

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	Select various sensing methods according to requirement.
2.	Fabricate semiconductor devices using micro machining techniques.
3.	Understand elements of micro system and design the micro system.
4.	Understand different micro fabrication systems.
5.	Understand measuring methods in micro machining.

	Course Contents	Hours
Unit 1	**Introduction** Introduction to Micro System design, Micro-machinability of materials, Micromachining materials and properties, micro fabrication technologies, Structural behaviour, sensing methods, micro scale transport – feedback system	**(06)**
Unit 2	**Micromechanics** Microstructure of materials, its connection to molecular structure and its consequences on macroscopic properties – Phase transformations in crystalline solids including martensite, ferroelectric, and diffusional phase transformations, twinning and domain patterns, smart materials	**(06)**
Unit 3	**Basic micro-fabrication** Bulk Processes, Surface Processes, Sacrificial Processes and Bonding Processes, Special machining: Laser beam micro machining, Electrical Discharge Machining, Ultrasonic Machining, Electro chemical Machining. Electron beam machining, Diamond micro machining.	**(07)**
Unit 4	**Mechanical micromachining** Theory of micromachining, Chip formation, Size effect in micromachining, micro-turning, micro-milling, micro-drilling, Micromachining tool design, Precision Grinding, Partial ductile mode grinding, Ultraprecision grinding, Binderless wheel, Free form optics.	**(07)**
Unit 5	**Semiconductor manufacturing** Basic requirements, clean room, yield model, Wafer IC manufacturing, feature micro fabrication technologies, PSM, IC industry, New Materials, Bonding and layer transfer, devices, micro fabrication industries.	**(07)**
Unit 6	**Measuring methods in micromachining** Stylus instruments, atomic force microscope, measurement of micromoles and slots using optical method, vibro-scanning method, elastic transmission method, computer aided measurement testing and diagnostics, surface integrity and other related measurements	**(06)**

Tutorials

Text Books

1.	Advanced Machining Processes by V. K. Jain, Allied Publishers Private Limited, New Delhi.
2.	Micromachining Processesby V. K. Jain (Editor), CRC Press.
3.	Introduction to Micromachining by V. K. Jain published by Narosa Publishers, New Delhi.
4	Sami Franssila, “Introduction to Micro Fabrication”, John Wiley and sons Ltd., UK, 2004, ISBN: 978-0-470-85106-7

Reference Books

1.	Micromachining Methodsby J.A. Mc Geough,Champan and Hall, London
2.	Madore J, “Fundamental of Micro Fabrication”, CRC Press, 2002
3.	Mark J. Jackson, “Microfabrication and Nanomanufacturing”, CRC Press, 2006
4.	Peter Van Zant, “Microchip fabrication”, McGraw Hill, 2004
5.	Micro-Cutting: Fundamentals and Applications by Cheng, Huo, Wiley Publication

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1114: Elective II - Mathematical Modelling and Simulation

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	do mathematical modelling of Physical systems of structural, thermal and fluid domains using lumped parameter approach
2.	do mathematical modelling of Physical systems of structural, thermal and fluid domains using distributed parameter approach
3.	perform computer simulations of different mathematical models
4.	Do Hands on practice on FFT analyser for different application
5.	Do Hands on practice on modal hammer kit for different application

	Course Contents	Hours
Unit 1	**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	**(05)**
Unit 2	**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	**(08)**
Unit 3	**Distributed modelling of Continuous systems (PDEs): Structural/Mechanical Systems:** Beam & Plate Static and Dynamic Models, Time/Frequency Response Analysis of Dynamic Systems,	**(06)**
Unit 4	**Modelling of thermal systems:** 1D & 2D steady and transient heat transfer	**(06)**
Unit 5	**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	**(07)**
Unit 6	**Introduction to MATLAB**	**(06)**
Tutorials		

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

Reference Books

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		

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1124: Elective II - MEMS and Nanotechnology

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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)	**(06)**
Unit 2	**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.	**(08)**
Unit 3	**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.	**(08)**
Unit 4	**Microsystem Design:** Design constraints and selection of materials, selection of manufacturing process, selection of signal transduction technique, electromechanical system and packaging.	**(05)**
Unit 5	**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.	**(06)**
Unit 6	**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	**(06)**

Tutorials

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.

Reference Books

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		

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1134: Elective II - Supply Chain Management & Logistics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials			CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course the students will able to

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

	Course Contents	Hours
Unit 1	**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	**(06)**
Unit 2	**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	**(08)**
Unit 3	**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	**(08)**
Unit 4	**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.	**(06)**
Unit 5	**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	**(06)**
Unit 6	**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. **Logistic in the Utilization and Support Phase**: - System / Product Support, TPM, Data Collection, Analysis and System Evaluation, Evaluation of Logistic Support Elements, System Modification	**(06)**

Tutorials

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
Reference Books	
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

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1144: Elective II - Work System Design

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	calculate the basic work content of a specific job for employees of an organization. Thereby they will be able to calculate the production capacity of man power of an organization
2.	analyse and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.
3.	rate a worker engaged on a live job and calculate basic, allowed and standard time for the same.
4.	analyse the existing methods of working for a particular job and develop an improved method through questioning technique.
5.	provide appropriate allowances for the jobs under analysis

	Course Contents	Hours
Unit 1	**Work system design** Introduction and Concept of Productivity, Measurement of Productivity, Productivity Measures, Productivity Measurement Models, Factors Influencing Productivity, Causes of Low Productivity, Productivity Measurement Models, Productivity Improvement Techniques, Numerical Problems on productivity, Case study on productivity.	**(07)**
Unit 2	**Work study** Basic Concept, Steps Involved in Work Study, Concept of Work Content, Techniques of Work Study, Human Aspects of Work Study.	**(07)**
Unit 3	**Method study** Basic Concept, Steps Involved in Method Study, Recording Techniques, Operation Process Charts, Operation Process Charts: Examples, Flow Process Charts, Flow Process Charts: Examples, Two-Handed-Process Charts, Multiple Activity Charts, Flow Diagrams, String Diagrams, Principles of Motion Economy, Micro-Motion Study, Therbligs, SIMO Charts, Development and Selection of New Method, Installation and Maintenance of Improved Methods, Critical Examination Techniques.	**(08)**
Unit 4	**Work measurement** Basic Concept, Techniques of Work Measurement, Steps Involved in Time Study, Steps and Equipment of Time Study, Performance Rating.	**(07)**
Unit 5	**Performance rating and work sampling** Allowances, Computation of Standard Time-I, Computation of Standard Time-II, Case Study, Examples, Basics, Procedure of Work Sampling Study, Numerical Problems on work sampling, Introduction to Synthetic Data and PMTS, Introduction to MTM and MOST.	**(08)**
Unit 6	**Ergonomics** Basic Concept, Industrial Ergonomics, Ergonomics: Anthropometry, Man-Machine System-1, Man-Machine System-2, Ergonomics design process, Environmental factors, Design ergonomics in India: scope for exploration.	**(07)**
Tutorials		

Text Books

1.	Introduction to Work Study: International Labor Office (ILO), Geneva.
2.	Barnes, R.M. Motion and Time Study, Design and measurement of work, John Wiley sons (Asia).
3.	Industrial Engineering and Production Management: M. Telsang, S. Chand and Company Ltd.

Reference Books

1.	Benjamin W.Niebel, Andris Freivalds, Methods, standards & Work Design, McGraw Hill
2.	Maynard H.B, Industrial Engineering Hand book, McGraw-Hill

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

RM1105: Research Methodology

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	02		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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	**(06)**
Unit 2	**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	**(07)**
Unit 3	**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	**(06)**
Unit 4	**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	**(06)**
Unit 5	**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	**(07)**
Unit 6	**Analysis of Variance:** Introduction, One-way ANOVA, Two-way ANOVA, Preparation of ANOVA Table and calculation of F-ratio	**(07)**

Text Books

1.	Analysis of Variance: Introduction, One-way ANOVA, Two-way ANOVA, Preparation of ANOVA Table and calculation of F-ratio
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

Reference Books

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

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1106: Lab Practice -I

Teaching Scheme			Examination Scheme	
Lectures	--		CT – 1	--
Practicals	4 Hrs/week		CT – 2	--
Total Credits	02		CA	25
			ESE	25
			Duration of ESE	02 Hrs 30 Min

Lab Outcomes (LO)

Students will be able to

1.	Measure dimensional and form tolerances after machining.
2.	Measure sound level during machining.
3.	Measure noise vibration of machine tool
4.	Measure tool wear and surface roughness

	Course Contents	Hours
Experiment 1	Profile milling operation on VMC.	**(04)**
Experiment 2	Circular pocketing/rectangular pocketing/drilling operation on VMC.	**(04)**
Experiment 3	Measurement of form tolerances (circularity, cylindricity and perpendicularity) using CMM.	**(04)**
Experiment 4	Demonstration of adaptive clamping mechanism using proportional hydraulic control valve.	**(04)**
Experiment 5	Robot programming for pick and place jobs with vision system / function of ASRS.	**(04)**
Experiment 6	Measurement of sound on CNC lathe machine during turning.	**(04)**
Experiment 7	Measurement of vibration on CNC lathe machine during turning.	**(04)**
Experiment 8	Measurement of tool wear using Tool Maker's Microscope.	**(04)**
Experiment 9	Measurement of Surface roughness after machining.	**(04)**
Experiment 10	Measurement of case depth on Micro Hardness Tester using case hardened components.	**(04)**

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

PE 1107: Lab Practice -II

Teaching Scheme			Examination Scheme	
Lectures	--		CT – 1	--
Practicals	4 Hrs/week		CT – 2	--
Total Credits	02		CA	25
			ESE	25
			Duration of ESE	02 Hrs 30 Min

Lab Outcomes (LO)

Students will be able to

1.	Manufacture component on EDM machine.
2.	Prepare a component on 3D printer using CAD model
3.	Find experimentally natural frequencies of component.
4.	Carry out modal analysis in Finite Element software.

	Course Contents	Hours
Experiment 1	Die designing and manufacturing on plastic moulding machine.	**(04)**
Experiment 2	Manufacturing component on Wire cut EDM machine	**(04)**
Experiment 3	To investigate the effect of metal removal rate (MRR), surface roughness on work piece on Wire cut EDM machine.	**(04)**
Experiment 4	To prepare component from 3D printer by using CAD model.	**(04)**
Experiment 5	To prepare a scanned model of 3D object using 3D scanner. Use of scanner for reverse engineering.	**(04)**
Experiment 6	Finding out natural frequencies of given component on vibration shaker	**(04)**
Experiment 7	Validation of experimental natural frequencies and mode shapes using software.	**(04)**
Experiment 8	Manufacturing labels on Ultrasonic cutting machine.	**(04)**

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

OE1138: Operations Research

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	apply the dynamic programming to solve problems of discreet and continuous variables.
2.	apply the concept of non-linear programming
3.	carry out sensitivity analysis
4.	model the real-world problem and simulate it.

	Course Contents	Hours
Unit 1	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models	**(06)**
Unit 2	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming	**(07)**
Unit 3	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT	**(06)**
Unit 4	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	**(06)**
Unit 5	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation	**(07)**

Text Books

1.	J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
2.	Hitler Libermann Operations Research: McGraw Hill Pub. 2009
3.	Pannerselvam, Operations Research: Prentice Hall of India 2010

Reference Books

1.	H.A. Taha, Operations Research, An Introduction, PHI, 2008
2.	H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3.	Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical-Production Engineering

AU1119: Research Paper Writing (Audit Course – 1)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	--
Tutorials	-		CT – 2	--
Total Credits	00		TA	--
			ESE	--
			Duration of ESE	--

Course Outcomes (CO)

At the end of the course students will able to:

1.	Understand that how to improve your writing skills and level of readability.
2.	Learn about what to write in each section.
3.	Understand the skills needed when writing a Title

	Course Contents	Hours
Unit 1	Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	**(04)**
Unit 2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	**(04)**
Unit 3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	**(04)**
Unit 4	Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	**(04)**
Unit 5	Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	**(04)**
Unit 6	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	**(04)**

Tutorials- --

Text Books

1.	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2.	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Reference Books

1.	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
2.	Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical- Production Engineering

AU1129: Disaster Management (Audit Course – I)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	--
Tutorials	-		CT – 2	--
Total Credits	00		TA	--
			ESE	--
			Duration of ESE	--

Course Outcomes (CO)

At the end of the course, the students will:

1.	learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
2.	critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
3.	develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

	Course Contents	Hours
Unit 1	**Introduction** Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.	**(04)**
Unit 2	**Repercussions of Disasters and Hazards:** Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. **Natural Disasters**: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, **Man-made disaster**: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	**(04)**
Unit 3	**Disaster Prone Areas in India** Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	**(04)**
Unit 4	**Disaster Preparedness and Management** Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental And Community Preparedness.	**(04)**
Unit 5	**Risk Assessment** Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques af Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival	**(04)**
Unit 6	**Disaster Mitigation** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Disaster Mitigation in India.	**(04)**

Text Books

1.	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.
2.	Sahni, Pardeep Et.Al. (Eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3.	Goel S. L., Disaster Administration and Management Text And Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1201: Advanced Casting Technology

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials			CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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.	**(05)**
Unit 2	**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,	**(08)**
Unit 3	**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.	**(08)**
Unit 4	**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	**(06)**
Unit 5	**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	**(06)**
Unit 6	**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,	**(06)**
Tutorials		

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.)
Reference Books	
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.simtech.a-star.edu.sg/.../pe _*metal _initiative advanced _casting*
3.	*www.castingstechnology.com/public/documents*
4.	*me.emu.edu.tr/me364/2*

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1202: Production & Operations Management

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials			CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	**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	**(07)**
Unit 2	**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	**(06)**
Unit 3	**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	**(06)**
Unit 4	**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	**(07)**
Unit 5	**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	**(08)**
Unit 6	**Theory of constraints**: Optimized Production Technology, Drum-rope-buffer models, Constant-WIP (CONWIP) models, Planning and Control of JIT Systems	**(05)**

Tutorials

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.

Reference Books

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		

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1213: Elective III - Computer Aided Engineering

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

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

	Course Contents	Hours
Unit 1	Introduction to solid modeling, Concepts of 3-D modelling	**(06)**
Unit 2	Model structure Engineering drawing. Fundamentals of assembly and sub-assembly	**(08)**
Unit 3	Parametric modeling, Advanced feature-based design	**(08)**
Unit 4	Fundamentals of modeling for finite element analysis, Analysis methods.	**(08)**
Unit 5	Design creativity, Design for manufacturability.	**(06)**
Unit 6	Real-world problems: critiques, analysis, and improvements.	**(06)**

Text Books

1.	R. Toogood. Pro-Engineer WildFire 4.0. Schroff Development Corporation. (2007). ISBN-13: 978-158503415

Reference Books

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)

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1223: Elective III - Noise and Vibration

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	understand the fundamentals of vibration
2.	apply the principles of vibration in single degree, two degree and multi degree of freedom systems
3.	analyze the mechanical system to reduce the vibrations
4.	develop mathematical model of mechanical system

	Course Contents	Hours
Unit 1	**Introduction** Vibration and oscillation, Causes and effects of vibrations, Vibration parameters – spring, mass, damper, damper models, Motion – periodic, non-periodic, harmonic, non- harmonic, Degree of freedom, Static equilibrium position, Vibration classification, Steps involved in vibration analysis, Simple harmonic motion, Vector and Complex method of representing vibration, Fourier series and harmonic analysis	**(06)**
Unit 2	**Two Degree of Freedom Systems** Generalized and Principal coordinates, Derivation of equations of motion, Eigen values and Eigen vectors, Mode shapes, Lagrange's equation, Coordinate coupling, Forced harmonic vibration	**(07)**
Unit 3	**Multi Degree of Freedom Systems** Derivation of equations of motion, Influence coefficient method, Properties of vibrating systems: flexibility and stiffness matrices, normal modes and their properties, reciprocity theorem, Modal analysis: undamped and damped,Numerical methods, Holzer's method, Stodala's method.	**(08)**
Unit 4	**Measurement of Vibration** Vibration Measuring devices, Accelerometers, Impact hammer, Vibration shaker-construction, principles of operation and uses, Vibration Analyzer, Signal analysis - Analysis of Vibration Spectrum, Standards related to measurement of vibration, Machine Conditioning and Monitoring, fault diagnosis	**(06)**
Unit 5	**Control of Vibration** Introduction to control of vibration, Vibration control methods, Passive and active vibration control, Reduction of excitation at the source, Control of natural frequency, Vibration isolators, Tunned Dynamic Vibration Absorbers	**(06)**
Unit 6	**Noise** Fundamentals of noise Sound concepts, Decibel Level, White noise, Weighted sound pressure level, Logarithmic addition, Subtraction and averaging, Sound intensity, Noise measurement, Sound fields, Octave band, Sound reflection, Absorption and transmission, Passby-noise, Reverberation chamber, Anechoic Chamber, Noise standards	**(08)**

Text Books

1.	"Mechanical Vibrations", S. S. Rao, Pearson Education, 6th edition, 2011
2.	"Mechanical Vibrations", G. K. Grover, Published by Nemchand and Brothers, Roorkee, 8th edition, 2009
3.	"Mechanical Vibration and industrial Noise"Lasithan L.G. PHI Learning Private Limited. 2014
4.	"Fundamentals of Vibrations", Balchandran, Magrab, Cengage Learning, 2nd edition, 2009.
5.	"Mechanical Vibration", Dr. Debabrata Nag, Wiley India Pvt. Ltd, 5th edition, 2011.

Reference Books

1.	"Mechanical Vibration", Austin Church, Wiely Eastern, 2nd edition.
2.	"Mechanical Vibrations", J.P. Den Hartog, Tata Mc-Graw Hill Book Company Inc., 3 rd edition, 2008

3.	"Elements of Vibration Analysis" Leonard Meirovitch, Tata Mc-Graw-Hill, New York, 2nd edition, 1986
4.	"Vibrations and Noise for Engineers", Kewal Pujara Dhanpat Rai and Sons, 4th edition, 2007
Useful Links	
1.	nptel.ac.in/courses/112104194/
2.	nptel.ac.in/courses/112107087/
3.	nptel.ac.in/courses/112104026/
4.	http://nptel.ac.in/courses/112103112/

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1233: Elective III - Fabrication Engineering &Welding Technology

Teaching Scheme		Examination Scheme	
Lectures	03 Hrs/week	CT – 1	15
Tutorials	--	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	perform different metal profile by selection of different cutting methods
2.	get required component by different fabrication techniques
3.	analyze welding defects which would happen during welding
4.	perform latest welding methods
5.	detect defective components manufactured by fabrication methods

	Course Contents	Hours
Unit 1	**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.	**(06)**
Unit 2	**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	**(07)**
Unit 3	**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	**(06)**
Unit 4	Weld Quality and Defects, failure of welds, inspection and testing of welds, I.S. code for welding and weldments, destructive tests for welds, microstructure for weld joints, welding defects and remedies	**(06)**
Unit 5	Modern welding processes like EBW, LBW, diffusion bonding, ultra sonic welding, pulsed current welding processes, and friction welding. Welding of ceramics, plastics and composites	**(07)**
Unit 6	Stage inspection in fabrication process, planning for fabrication jobs	**(07)**

Tutorials:--

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.

Reference Books

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.	www.sciencedirect.com/science/book/9780750666916
2.	unesdoc.unesco.org/images/0016/001613/161340e

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1214: Elective IV- Industrial Automation and Robotics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course the students will able to

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

	Course Contents	Hours
Unit 1	**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.	**(06)**
Unit 2	**Transfer Lines:** Fundamentals, Configurations, Transfer mechanisms, storage buffers, control, applications; Analysis of transfer lines without and with storage buffers	**(06)**
Unit 3	**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.	**(07)**
Unit 4	**Fundamentals of Industrial Robots:** Specifications and Characteristics, Basic components, configurations, Criteria for selection, various industrial applications	**(06)**
Unit 5	**Robotic Control Systems:** Drives, Robot Motions, Actuators, Power transmission systems, Robot controllers, Dynamic properties of robots- stability, control resolution, spatial resolution, accuracy, repeatability, compliance.	**(07)**
Unit 6	**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	**(07)**

Tutorials:-

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.)

Reference Books

1.	Keramas, James G. (1998), "Robot Technology Fundamentals".
2.	Noff, Shimon Y. "Handbook of Robotics", (John Wiley & Sons)
3.	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).

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1224: Elective-IV Automatic Control Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	-		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course the students will able to

1.	identify application-wise components of feedback control systems.
2.	apply mathematical models of physical systems in the analysis and design of control systems.
3.	develop block diagram representation for mechanical, electrical, thermal, liquid level, hydraulic, pneumatic, gear train systems, etc.
4.	analyse the time and frequency-domain responses of first and second-order systems to step, ramp, parabolic, sinusoidal and impulse inputs.
5.	acquire the collected information that will assist in the solution of many problems encountered in the application of Control Engineering in the industry.

	Course Contents	**Hours**
Unit 1	**Mathematical Modelling** Types of control systems, Servomechanism, Mathematical model of a system- Mechanical, Electrical, Liquid level, Pneumatic, Hydraulic, Thermal, Gear train,	**(05)**
Unit 2	**Characteristics of Feedback Control System** Sensitivity of control systems to parameter variations, Effect of feedback on overall systems gain, Sensitivity, System dynamic, Steady state error, Effect of disturbance signals, Systems with positive signals.	**(10)**
Unit 3	**Block Diagram Representation of Control System Components** Block diagrams, block diagram algebra, rules for reduction of block diagram, block diagram development of system components- Armature and Field controlled DC motor, Inverted pendulum, DC and AC servomotors, Stepper motor, Sensors- Potentiometers, Synchros, Tachometers, LVDT, Mechanical accelerometers, water heating system, thermometer, hydraulic actuator, pneumatic actuator, liquid level system, hydraulic servomotor, jet-pipe amplifier, pneumatic amplifier. Magnetic amplifiers, Operational amplifiers.	**(06)**
Unit 4	**Time Domain Analysis** Standard test signals- step, ramp, parabolic, impulse, exponential, sinusoidal, concept of poles and zeros, distinct, repeated and complex poles. response of first and second order systems to inputs -step, ramp and impulse, damping ratio and natural frequency, transient response specifications	**(06)**
Unit 5	System representation in time and Laplace domain, modelling electrical and mechanical systems, construction of simulation diagrams, transfer function from state space model.	**(07)**
Unit 6	Frequency domain approach, magnitude plots and phase angle plots, bode plots, gain margin, phase margin, polar plots and stability determination.	**(06)**

Tutorials-

Text Books

1.	"Control System Engineering", R Anand Natarajan, P. Ramesh Babu, SciTech Publication, 2nd Edition'.
2.	"Control Systems", A. Anand Kumar, Prentice Hall Publication, 1st Edition.
3.	"Modern Control Systems", K. Ogata, Prentice Hall Publication, 3rd Edition.
4.	"Automatic Control Engineering", D. Roy and Choudhari, Orient Longman Publication Calcutta, 1st Edition.

Reference Books

1.	"Automatic Control Engineering", F.H. Raven Tata McGraw Hill Publication, 5th Edition.
2.	"Automatic Control Systems", B.C. Kuo, Willey India Ltd. / Prentice Hall Publication, 7th Edition.
3.	"Control System Analysis and Design", A. K. Tripathi, Dinesh Chandra, New Age International Publishers, 1st Edition.

4	"Modern Control Systems", Richard C. Dorf, Robert H. Bishop, Prentice Hall, 1st Edition, 2008.
Useful Links	
1.	www.ieeecss.org
2.	www.controlengineering.com
3.	www.journals.elsevier.com/control-engineering-practice
4.	www.learnerstv.com/Free-engineering-Video-lectures-ltv

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1234: Elective IV- Plastic Process & Die Design

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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 1	**Plastic materials** Classification of plastic materials, their physical and mechanical properties, selection of plastics for various applications, advantages and limitations of using plastics	**(06)**
Unit 2	**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.	**(07)**
Unit 3	**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.	**(06)**
Unit 4	**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	**(06)**
Unit 5	**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	**(07)**
Unit 6	**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.	**(07)**

Tutorials

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

Reference Books

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.

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1244: Elective IV- Product Life Cycle Management PLM

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

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

1.	understand the latest material on PLM and its impact on the organization.
2.	have an overview of the current thinking on the principles, strategies, practices, and applications of Product Lifecycle Management followed by an in-depth look at specific areas of PLM that are the focus of today's innovative organizations.
3.	conceptual underpinnings of PLM, along with the newest industry views on PLM applications.
4.	design frameworks which provide economic justifications for PLM projects
5	demonstrate the pitfalls of a piecemeal approach to PLM.
6.	create PLM concept with recent advancements

	Course Contents	Hours
Unit 1	**INTRODUCTION** Background, Overview, Need, Benefits, Concept of Product Life Cycle. Components / Elements of PLM, Emergence of PLM, Significance of PLM, Customer Involvement. **PRODUCT LIFE CYCLE ENVIRONMENT**: Product Data and Product Workflow, Company's PLM vision, The PLM Strategy, Principles for PLM strategy, Preparing for the PLM strategy, Developing a PLM strategy, Strategy identification and selection, Change Management for PLM	**(07)**
Unit 2	**COMPONENTS OF PLM:** Different phases of product lifecycle and corresponding technologies, Product development processes and methodologies, Foundation technologies and standards (e.g. visualization, collaboration and enterprise application integration), Information authoring tools (e.g., MCAD, ECAD, and technical publishing), Core functions (e.g., data vaults, document and content management, workflow and program management), Functional Applications. (e.g., configuration management) Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards, Vendors of PLM Systems and Components, Examples of PLM in use.	**(06)**
Unit 3	**PRODUCT DEVELOPMENT PROCESS METHODOLOGIES:** Integrated Product, development process - Conceive – Specification, Concept design, Design - Detailed design, Validation and analysis (simulation), Tool design, Realize – Plan manufacturing , Manufacture, Build/Assemble , Test (quality check) , Service - Sell and Deliver , Use , Maintain and Support, Dispose. Bottom-up design, Top-down design, Front loading design workflow, Design in Context, Modular design. Concurrent engineering - work structuring and team Deployment -Product and process systemization - problem, identification and solving methodologies. Product Reliability, Mortality Curve. Design for Manufacturing, Design for Assembly. Design for Six Sigma.	**(08)**
Unit 4	**PRODUCT MODELLING:** Product Modelling - Definition of concepts – Fundamental issues- Role of Process chains and product models -Types of product models – model standardization efforts- types of process chains - Industrial demands. **TYPES OF ANALYSIS TOOLS:** Design for manufacturing - machining - casting and metal forming - optimum design - Design for assembly and disassembly – probabilistic design concepts - FMEA - QFD - Taguchi Method for design of experiments -Design for product life cycle. Estimation of Manufacturing costs, Reducing the component costs and assembly costs, Minimize system complexity.	**(07)**

Uit 5	**PRODUCT DATA MANAGEMENT (PDM) TECHNOLOGY –** Product Data Management – An Introduction to Concepts, Benefits and Terminology, CIM Data. PDM functions, definition and architectures of PDM systems, product data interchange, portal integration, PDM acquisition and implementation**.**	**(06)**
Unit 6	**RECENT ADVANCES**: Intelligent Information Systems - Knowledge based product and process models - Applications of soft computing in product development process - Advanced Database design for integrated manufacturing.	**(06)**

Text Books

1.	Grieves, Michael. Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303
2.	Product Life Cycle Management -, Antti Saaksvuori, Anselmi Immonen, Springer, 1 st Edition (Nov.5, 2003)
3.	Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 2004. ISBN 1852338105
4	Product Design & Process Engineering, McGraw Hill – Kogalkusha Ltd., Tokyo, 1974.
5	Product Design & Development , Kari Ulrich and Steven D. Eppinger, McGraw Hill International Edns, 1999.

Reference Books

1.	Effective Product Design and Development ,Stephen Rosenthol, Business One Orwin, Homewood, 1992 ISBN 1-55623-603-4.
2.	Burden, Rodger PDM: Product Data Management, Resource Pub, 2003. ISBN 0970035225
3.	Fan, D. (Ed.), Virtual Reality for Industrial Applications, Springer.

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1215: Fundamentals of Surface Engineering: Mechanisms, Processes and Characterizations (Elective-V)

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course student will able to:

1.	Understand the effect of friction and wear on surface engineering.
2.	Understand wear mechanisms and materials for controlling wear.
3.	Know surface modifications and processes for controlling wear
4.	Know surface coating processes and characterisation of surfaces.

	Course Contents	Hours
Unit 1	**Introduction** Purpose and need of surface engineering, Surface sub-surface regions, Classification of surface modification techniques, Scope of surface engineering, Role of surface properties on friction and wear. **Wear Mechanisms I** Advantages and limitations of surface engineering, Materials properties and its effect on performance of components, Fundamentals of wear mechanism: Adhesive wear, Fundamentals of wear mechanism: Abrasive wear, Fundamentals of wear mechanism: Surface fatigue wear	**(06)**
Unit 2	**Wear Mechanisms II** Fundamentals of wear mechanism: Corrosion wear, Fundamentals of wear mechanism: Cavitation wear, Fundamentals of wear mechanism: Erosion wear & Fretting wear, Fundamentals of wear mechanism: Diffusive wear & Seizure, Evaluation of damage on wear surfaces. **Materials for Controlling Wear** Material properties for controlling wear, Material properties for specific type of wear Structure and wear relationship for materials of commercial importance, New coating system: FGM, TBCs, Guidelines for selection of materials for engineering the surface	**(06)**
Unit 3	**Processes for Controlling Wear: Structural Modification** Fundamental approaches of structural modification, Candidate materials for structural modification, Processes: Localised plastic deformation I (FSP), Processes: Localised plastic deformation II (Shot peening), Processes: Localised plastic deformation II (Burnishing) **Processes for Controlling Wear: Structure & Composition Modification** Processes: Transformation hardening, Laser Hardening), Advantages, limitations and application, Fundamental approach of changing chemical composition, Candidate material for controlling wear	**(10)**
Unit 4	**Processes for Controlling Wear: Composition Modification** Carburizing and plasma carburizing, Carbo-nitriding & Cyaniding, Nitriding and plasma nitriding, Chromizing & Aluminizing, Boronizing **Processes for Controlling Wear: Composition Modification** Laser Plasma TIG alloying, Vapour deposition & Ion implantation, Chemical vapour deposition (CVD) & Ion bean assisted CVD, Physical vapour deposition, Advantages, limitations and application	**(06)**
Unit 5	**Processes for Controlling Wear: Coatings & Overlays** Fundamentals of approach, Heat input, & dilution, Candidate material for controlling wear, Approaches: Welding based methods: I, Approaches: Welding based methods: II **Processes for Controlling Wear: Coatings & Overlays**	**(05)**

	Approaches: Laser cladding, Thermal spray-based methods I, Thermal spray-based methods II, Thermal spray-based methods III, Thermal spray-based methods IV	
Unit 6	**Processes for Controlling Wear: Coatings & Characterization** Approaches: Electrolysis based methods, Advantages, limitations and application Purpose, Characterization of soundness, Thickness measurement, Surface roughness measurement **Characterization of Engineered Surfaces** Mechanical properties, Chemical properties, Metallurgical properties, Wear properties I, Wear properties II	**(05)**

Text Books	
1.	P.N. Rao, "Manufacturing Technology Vol 2", McGraw-Hill Publication, 4th edition, 2018
2.	D K Dwivedi, Surface Engineering: Enhancing life of tribological component, Springer (2017) New Delhi
3.	Jamal Takadoum, Materials and Surface Engineering in Tribology, Willey (2007), London
Reference Books	
1.	ASM Handbook, Surface Engineering, ASM, (1995) Ohio
2.	A W Batchelor et al., Materials Degradation and its control by surface engineering, Imperial College Press, (2006), London
3.	Tadeusz Burakowski, Tadeusz Wierzchon, Surface engineering in metals, CRC Press (1999) London
Useful Links	
1.	https://nptel.ac.in/courses/112/107/112107248/
2.	https://nptel.ac.in/content/syllabus_pdf/112107248.pdf

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1225: Mechanics of Machining (Elective-V)

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course student will able to:

1.	Understand the deformation process and machining processes
2.	Understand different types cutting tool used
3.	Analyse and calculated different cutting forces involve in machining processes.
4.	Know non-traditional machining process
5.	Know advances in metal removing process

	Course Contents	Hours
Unit 1	Deformation of metals, Mechanism of plastic deformation, Machining processes: Single edge tool, types of chips	**(06)**
Unit 2	Tool geometry: single point cutting tool specifications, Tool specifications, conversion of tool angles, Multi-point cutting tools, Mechanics of orthogonal cutting, force relationships	**(06)**
Unit 3	Determination of stress, strain, and strain rate, Measurement of shear angle, Other analysis for force relationships. Mechanics of oblique cutting, Measurement of cutting forces Thermal aspects of machining: Temperatures in orthogonal cutting, Tool wear and tool life and tool-life equations Economics in machining	**(10)**
Unit 4	Practical machining operations: Turning and shaping & planning operation, Practical machining operations: milling and drilling, Grinding of metals and mechanics of grinding process	**(06)**
Unit 5	Abrasive machining and finishing operations, CNC machines and CNC programming	**(05)**
Unit 6	Introduction to advanced machining processes, Recent trends in machining processes	**(05)**

Tutorials:--

Text Books

1.	P.N. Rao, "Manufacturing Technology Vol 2", McGraw-Hill Publication, 4th edition, 2018
2.	B.L Juneja, G.S. Shekhon, Nitin Seth, "Fundamentals of Metal Cutting and Machine Tools ", Newage International Publishers, 2017
3.	Dr. Swadesh Kumar Singh , "A Text Book on Production Engineering " Made Easy Publication, 3rd edition,

Reference Books

1.	P.C Sharma " A text book of Production Engineering" S. Chand
2.	Amitabh Gosh & A.K Malik, "Manufacturing Science", 2nd Ed, East-West Press, 2010
3.	Geoffrey Boothroyd, Winston A. Knight, " Fundamentals of Metal machining and Machine Tools", CRC Press, 3rd edition, 2005

Useful Links

1.	https://nptel.ac.in/courses/112/103/112103248/
2.	https://nptel.ac.in/content/syllabus_pdf/112103248.pdf
3.	https://swayam.gov.in/nd1_noc20_me41/preview

Government College of Engineering, Karad				
First Year (Sem – II) M. Tech. Mechanical-Production Engineering				
PE 1206: Lab Practice -III				
Teaching Scheme			**Examination Scheme**	
Lectures	--		CT – 1	
Practicals	4 Hrs/week		CT – 2	
Total Credits	02		CA	25
			ESE	25
			Duration of ESE	02 Hrs 30 Min

Lab Outcomes (LO)

At the end of the course students will be able to:

1.	Perform structural and modal analysis in finite element analysis (FEA) software
2.	Perform casting defect analysis using simulation software.
3.	Design gating system for defect free casting.
4.	Write MATLAB program for given problem.

	Course Contents	Hours
Experiment 1	Development of any solid model assembly and details using CAD modeling packages	**(04)**
Experiment 2	Structural analysis of simple assembly using FEA software	**(04)**
Experiment 3	Modal analysis of simple assembly using FEA software	**(04)**
Experiment 4	Defect analysis of casting using simulation software	**(04)**
Experiment 5	Design of gating system to manufacture defect free casting using simulation software	**(04)**
Experiment 6	Generation of cooling curve at given section of casting using simulation software	**(04)**
Experiment 7	Single Dof model on MATLAB software	
Experiment 8	Multi Dof model on MATLAB software.	

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1207: Lab Practice -IV

Teaching Scheme			Examination Scheme	
Lectures	--		CT – 1	
Practicals	4 Hrs/week		CT – 2	
Total Credits	02		CA	25
			ESE	25
			Duration of ESE	02 Hrs 30 Min

Lab Outcomes (LO)

At the end of the course students will be able to

1.	Simulate hydraulic circuits using automation studio software.
2.	Measure cutting forces on lathe and milling machines.
3.	Write program for robot and AGV.
4.	Analyze phases in microstructures of ferrous and non-ferrous materials.

	Course Contents	Hours
Experiment 1	Simulation of hydraulic circuits in a hydraulic trainer / single and double acting cylinder circuit using Automation Studio software	**(04)**
Experiment 2	Simulation of electro-pneumatic latch circuit/logic pneumatic circuit/electro-pneumatic sequencing circuit using Automation Studio software	**(04)**
Experiment 3	Measurement of cutting forces during slot milling operation	**(04)**
Experiment 4	Measurement of cutting forces during turning operation	**(04)**
Experiment 5	Programming for integration of robot and AGV	**(04)**
Experiment 6	Analysis of phases in microstructure of steel	**(04)**
Experiment 7	Analysis of phases in microstructure of cast iron	**(04)**
Experiment 8	Analysis of phases in microstructure of non-ferrous materials.	**(04)**

Government College of Engineering, Karad

First Year (Sem – II) M. Tech. Mechanical-Production Engineering

PE 1208: Seminar on Pre-dissertation Work

Teaching Scheme			Examination Scheme	
Lectures	--		CT – 1	--
Practicals	04 Hrs/week		CT – 2	--
Total Credits	02		TA	50
			ESE	50
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

At the end of the course the students will be

1.	exposed to self-learning various topics.
2.	learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
3.	learn to write technical reports

	Course Contents	Hours
	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 Seminar Report	

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical- Production Engineering

AU1219: Constitution of India (Audit Course – II)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	--
Tutorials	-		CT – 2	--
Total Credits	00		TA	--
			ESE	--
			Duration of ESE	--

Course Outcomes (CO)

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

1.	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2.	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3.	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4.	Discuss the passage of the Hindu Code Bill of 1956.

	Course Contents	Hours
Unit 1	**History of Making of the Indian Constitution** History Drafting Committee, (Composition & Working)	**(04)**
Unit 2	**Philosophy of the Indian Constitution** Preamble Salient Features	**(04)**
Unit 3	**Contours of Constitutional Rights & Duties** Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	**(04)**
Unit 4	**Organs of Governance** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions	**(04)**
Unit 5	**Local Administration** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	**(04)**
Unit 6	**Election Commission** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women	**(04)**

Text Books

1.	The Constitution of India, 1950 (Bare Act), Government Publication.
2.	Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3.	M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014
4.	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Government College of Engineering, Karad

First Year (Sem – I) M. Tech. Mechanical- Production Engineering

AU1229: Pedagogy Studies (Audit Course – II)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		CT – 1	--
Tutorials	-		CT – 2	--
Total Credits	00		TA	--
			ESE	--
			Duration of ESE	--

Course Outcomes (CO)

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

1.	What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2.	What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3.	How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

	Course Contents	Hours
Unit 1	**Introduction and Methodology** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.	**(04)**
Unit 2	**Thematic overview** Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	**(02)**
Unit 3	**Evidence on the effectiveness of pedagogical practices**, Methodology for the in-depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change, Strength and nature of the body of evidence for effective pedagogical practices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.	**(04)**
Unit 4	**Professional development** Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment. Barriers to learning: limited resources and large class sizes	**(04)**
Unit 5	**Research gaps and future directions** Research design, Contexts 2 Model Curriculum of Engineering & Technology PG Courses [Volume-I] [46], Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.	**(04)**

Text Books

1.	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2.	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3.	Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

Reference Books

	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282
	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
	Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

Useful links

	www.pratham.org/images/resource%20working%20paper%202.pdf

Government College of Engineering, Karad

Second Year (Sem – III) M. Tech. Mechanical-Production Engineering

PE 1301: Dissertation Phase- I

Teaching Scheme			Examination Scheme	
Lectures	--		CT – 1	
Practicals	32 Hrs/week		CT – 2	
Total Credits	16		CA	50
			ESE	50

Course Outcomes (CO)

At the end of the course the students will be

1.	exposed to self-learning various topics.
2.	able to learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
3.	able to learn to write technical reports
4.	able to develop oral and written communication skills to present and defend their work in front of technically qualified audience.

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	Hours
	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. 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 Project/Dissertation Report	

Government College of Engineering, Karad				
Second Year (Sem – III) M. Tech. Mechanical-Production Engineering				
PE 1302: MOOC online course				
Teaching Scheme			**Examination Scheme**	
Lectures	--		-	
Practicals	-		-	
Total Credits	03			

Online courses available on digital platform like Moocs/ NPTEL/ Coursera etc., during the academic semester will be reviewed and listed by departmental faculty board before start of every semester. Suitable course for registered candidate will be recommended by seminar / dissertation guide and programme head considering skill sets and knowledge required for dissertation work of the individual candidate from the list. It shall have minimum 8-12 weeks duration, peer graded assignment and examination to award grade by online course offering agency. It will be approved by Program Head case to case.

In case online course is not available, departmental committee will specially design syllabus for course under self-learning mode and guide will conduct end semester examination to award the grade.

Government College of Engineering, Karad

Second Year (Sem – IV) M. Tech. Mechanical-Production Engineering

PE 1401: Dissertation Phase -II

Teaching Scheme			Examination Scheme	
Lectures			CT – 1	
Practicals	32 Hrs/week		CT – 2	
Total Credits	16		CA	100
			ESE	200

Course Outcomes (CO)

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

1.	design and develop an experimental set up/ equipment/test rig.
2.	conduct tests on existing set ups/ Equipments and draw logical conclusions from the results after analyzing them.
3.	either work in a research environment or in an industrial environment.
4.	conversant with technical report writing.
5.	present and convince their topic of study to the engineering community.

	Course Contents	Hours
	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 Bibliography (the source of illustrative matter be acknowledged clearly at appropriate place IEEE/ASME/Elsevier Format)	
	List of Submission Project/Dissertation Report	