Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Programme: Mechanical Engineering

Curriculum for
Third year of B. Tech

Government College of Engineering, Karad
Third Year B. Tech.
ME501: Control Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	03Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	03	**TA**	10
		ESE	60
		ESE Duration	2 Hrs.30 min.

Course Objectives

1. To introduce to students about basic types, applications and generalized control system
2. To develop mathematical models and construct block diagrams for control system
3. To identify transient response of control system for various test signals
4. To develop an ability to design and utilize advanced control systems using state space and frequency response analysis

Course Contents

		Hours
Unit I	**Basics of Control Systems** Background, definitions, classification of control systems- natural, manmade, combinational, time varying and time-invariant, linear and nonlinear, lumped parameter and distributed parameter, SISO and MIMO systems, open loop and closed loop systems, real time applications of open loop and closed loop systems, comparisons, position control system-servomechanisms, regulating systems-regulators, generalized control system, requirements of an ideal control systems, linearization of non linear functions, linearization of operating curves	**06**
Unit II	**Mathematical Model of Control System** Concept of transfer function, mechanical translational/ rotational systems, electrical systems, equivalent mechanical system –node basis, grounded chair representation, analogous systems- FV and FI analog, thermal system, hydraulic/pneumatic system, gear train	**07**
Unit III	**Block Diagram Representation of Control System Components** Block diagrams, block diagram algebra, rules for reduction of block diagram, block diagram development of system components- DC and AC servomotors, water heating system, thermometer, hydraulic actuator, pneumatic actuator, liquid level system, hydraulic servomotor, jet-pipe amplifier, pneumatic amplifier, hydraulic steering/ copying mechanism	**07**
Unit IV	**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	**07**
Unit V	**State Space Analysis** System representation in time and Laplace domain, modeling electrical and mechanical systems, construction of simulation diagrams, transfer function from state space model	**06**
Unit VI	**Frequency Response Analysis** Frequency domain approach, magnitude plots and phase angle plots, bode plots, gain margin, phase margin, polar plots and stability determination	**07**

Note- Mathematical treatment for unit IV, V and VI should be given to the physical systems for which governing equations are derived in unit I, II and III

Course Outcome (CO): At the end of this course, students will be 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. Analyze the time and frequency-domain responses of first and second-order systems to step, ramp, parabolic, sinusoidal and impulse inputs

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

References:

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

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓			✓					✓		✓				✓
CO2	✓	✓	✓	✓	✓				✓		✓	✓	✓		✓
CO3	✓		✓	✓	✓						✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓						✓	✓	✓		✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	10
Understand	3	3	1	16
Apply	4	4	3	10
Analyze	3	3	2	12
Evaluate	2	2	2	12
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME502: Dynamics of Machines

Teaching Scheme		**Examination Scheme**	
Lectures	3Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60
		ESE Duration	2 Hrs.30min.

Course Objectives

1. To equip students with fundamental knowledge of dynamics of machines so that they can appreciate problems in dynamic force balance, gear trains, flywheel and gyroscopes
2. To give awareness to students on the phenomenon of vibration and its effects
3. To introducing the approaches and mathematical models used dynamical analysis of machinery

Course Contents **Hours**

Unit I **Toothed Gearing** **7**

Geometry of motion, gear geometry, types of gear profile- involute and cycloidal, theory of spur, helical and spiral gears, interference in involute tooth gears and methods for its prevention, path of contact, contact ratio, efficiency and centre distance of spiral gears

Unit II **Gear Trains** **6**

Types of gear trains - simple, compound, reverted, epicyclic gear train, tabular method for finding the speeds of elements in epicyclic gear train, torques in epicyclic gear train, differential gear box, equivalent mass and moment of inertia applied to gear trains

Unit III **Balancing** **8**

Static and dynamic balancing of rotary and reciprocating masses, primary and secondary forces and couples. direct and reverse cranks, balancing of single cylinder, multi cylinder, in-line and radial engines for four wheeler

Unit IV **Gyroscope** **6**

Gyroscopic couple, spinning and precessional motion, gyroscopic couple and its effect on i) Aero plane ii) Ship iii) Four-wheeler iv) Two –wheeler

Unit V **Mechanical Vibrations** **8**

Basic concepts and definitions, types of vibrations, equivalent springs, equation of motion, types of damping, SDOF free vibrations with and without damping, logarithmic decrement. SDOF forced vibrations with and without damping, magnification factor, frequency response curves, vibration isolation and transmissibility

Unit VI **Flywheel** **5**

Turning moment diagrams, fluctuation of energy, coefficient of fluctuation of speed, rimmed flywheel

Course Outcome (CO): At the end of this course, students will be able to

1. Apply the fundamental principles of kinematics and dynamics to machinery
2. Comprehend gyroscopic principle and effect of gyroscopic couple on naval ship, aero plane, etc.
3. Apply balancing methods to balance rotating and reciprocating components
4. Identify and analyze vibrations of single degree of freedom systems

Text Books:

1. "Theory of Machines", Rattan S. S., Tata McGraw Hill, 3rd Edition

2. "Theory of Machines", Sadhu Singh, Pearson Education, 3rd Edition
3. "Theory of Machines", Jagdishlal, Metropolitan Publication, 2nd Edition
4. "Theory of Machines", Ballaney, Khanna Publication, 4th Edition
5. "Theory of Machines", V. P. Singh, Dhanpat Rai Publications, 3rd Edition

References:

1. "Theory of Machines and Mechanisms", Shigley, Tata McGraw Hill, 4th Edition
2. "Theory of machines", Thomas Beven, Pearson Education, 3rd Edition
3. "Mechanism and Machine Theory", Rao, Dukkipati, New Age International, 2nd Edition
4. "Mechanisms and Dynamics of Machines", J. Srinivas, SciTech Publication, 2nd Edition
5. "Kinematics, Dynamics and Design of Machinery", Walidron, Wiley India Publication, 2nd Edition

Useful Links:

1. http://nptel.ac.in/courses/112104114/
2. http://nptel.ac.in/courses/112104121/1

Mapping of COswith POs (a to l) and PSOs (m, n, o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓		✓								✓	✓		✓	
CO2	✓				✓										
CO3	✓	✓	✓		✓									✓	
CO4	✓	✓	✓		✓									✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	10
Understand	4	4	1	16
Apply	4	4	3	16
Analyze	3	3	3	10
Evaluate	2	2	2	08
Create	0	0	1	00
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME 503: Heat and Mass Transfer

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60
		ESE Duration	2Hrs.30 min.

Course Objectives

1. To familiarize the students with fundamental principles/laws of heat transfer by conduction, convection, and radiation and mass transfer by diffusion and convection
2. To provide a technical **understanding** of common engineering processes and significance of different dimensionless numbers related with heat and mass transfer
3. To impart skills of modelling and analysing simple heat and mass transfer problems using **computer software**
4. To familiarize the students wit**h current developments** such as heat transfer in electronics and process industries in the field of heat and mass transfer to cope up with **requirements of industry**

Course Contents **Hours**

Unit I **Introduction to Heat and Mass Transfer** **07**

Modes of heat transfer, basic laws of heat transfer, introduction to combined modes of heat transfer, thermal conductivity and its variation with temperature for various engineering materials (description only), Nano fluids, introduction to mass transfer: modes of mass transfer, analogy between heat, mass and momentum transfer, Fick's law of diffusion, various dimensionless numbers.

Derivation of generalized differential equation of heat conduction in cartesian coordinates and its reduction to Fourier, Laplace and Poisson's equations, generalized heat conduction equation in cylindrical and spherical coordinates (no derivation)

One dimensional steady state heat conduction without heat generation: Reduction of generalized differential equation of heat conduction to one dimension (1D), heat conduction through plane wall, cylinder, sphere; electrical analogy; concept of thermal resistance and conductance, composite slab, composite cylinder and composite sphere, critical radius of insulation for cylinder and sphere, economic thickness of insulation

Unit II **Heat Conduction with Heat Generation and Unsteady State Heat Conduction One dimensional Steady State Heat Conduction with Heat Generation** **06**

One dimensional steady state heat conduction with uniform heat generation for plane wall cylinder, and sphere

One Dimensional Unsteady State Heat Conduction

Lumped Heat capacity Analysis, Biot and Fourier number and their significance, (numerically based on lumped heat capacity analysis), use of Hiesler and Grober charts (no numerical based on Hiesler and Grober charts)

Unit III **Extended Surfaces : Boundary and Initial Conditions** **07**

Temperature boundary conditions, heat flux boundary condition, convection boundary condition and radiation boundary condition

Heat Transfer Through Extended Surfaces

Types and applications of fins, heat transfer from rectangular and pin fins, fin effectiveness and efficiency, error estimation in temperature measurement in thermos-well

Unit IV Convection Fundamentals of Convection **07**

Mechanism of natural and forced convection, concept of hydrodynamic and thermal boundary layer, local and average convective coefficient for laminar and turbulent flow for flat plate and pipe

Forced Convection

Dimensional analysis, physical significance of dimension less numbers, Reynolds analogy for laminar flow, correlations for forced convection over flat plate and closed conduits

Natural or Free Convection

Dimensional analysis, physical significance of dimensionless numbers, correlations for natural convection over vertical plate cylinder sphere and flow patterns

Unit V Radiation **06**

Nature of thermal radiation, absorptivity, reflectivity, transmissivity, emissive power and emissivity, spectral and total concept, blackbody, grey body, and white body Kirchhoff's law, Wein's law and Planck's law, and deduction of Stefan Boltzmann law, Lambert cosine rule, Intensity of radiation, energy exchange by radiation between two black surfaces with non- absorbing medium in between and in absence of reradiating surfaces, Shape factor and its characteristics, energy exchange by radiation between two grey surfaces without absorbing medium, concept of radiosity and irradiation, radiation network method, network for two surfaces which see each other and nothing else, radiation shields

Unit VI Heat Exchangers and Phase Change Phenomenon **07**

Heat Exchangers:

Classification and types of heat exchangers, fouling factor, and overall heat transfer coefficient, heat exchanger analysis using LMTD and NTU methods for parallel and counter flow, design consideration of heat exchangers and introduction to design standards like TEMA

Boiling and Condensation (Descriptive treatment only)

Types of boiling, pool boiling and forced convection boiling, Nusselt's theory of condensation for vertical plate, Condensation correlations for practical applications, film wise and drop wise condensation, promoters

Course Outcome (CO): At the end of this course, students will acquire

1. **Knowledge** of basic heat transfer mechanisms (conduction, convection and radiation)
2. **Skills to** calculate heat transfer by conduction, convection and radiation for practical situations, analyse heat transfer in complex systems
3. **Basic competency** related to other courses involving thermal energy systems and processes
4. **General competency** skills in analysing and calculating heat transfer in complex problems and heat transfer equipment

Text Books:

1. "Heat Transfer", J. P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition (2007)
2. "Fundamentals of Heat and Mass Transfer", R. C. Sachdeva, Willey Eastern Ltd., 2012
3. "A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman, Hyderabad (2005)
4. "Heat and Mass Transfer", S. C. Arrora and S. Domkoundwar, Dhanpat Rai and Sons, Delhi (2012)

References:

1. "Heat Transfer –A Practical approach", Yunus A . Cengel, Tata McGraw Hill, (2015)
2. "Heat Transfer" Chapman A. J., Tata McGraw Hill Book Company, New York, (1960)
3. "Fundamentals of Heat and Mass Transfer", Frank P. Incropera, David P. Dewitt, Wiley India. 7th Edition, (2011)

Useful Links:

1. http://www.sciencedirect.com/science/bookseries
2. http://www.thermalfluidscentral.org/e-books
3. http://www.elsevier.com/books/advances-in-heat-transfer
4. http://www.ecs.umass.edu/mie/faculty/rothstein/mie606_fall02.pdf

Mapping of COswith POs (a to l) and PSOs (m, n, o)

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1		✓								✓	✓		✓	✓	✓
CO 2	✓		✓		✓			✓							
CO 3				✓		✓			✓						
CO 4				✓			✓		✓		✓	✓			

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	4	4	0	12
Understand	4	4	1	16
Apply	3	*3*	3	12
Analyze	2	2	3	08
Evaluate	2	2	2	08
Create	0	0	1	04
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME504: Machine Design - I

Teaching Scheme		Examination Scheme	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		ESE Duration	2Hrs.30 min.

Course Objectives

1. To familiarize the students with the concept of design and design procedure of machine elements
2. To familiarize the students with selection of material and failure theories of different machine elements
3. Design machine elements subjected to static loading
4. Design machine elements subjected to fluctuating loading

Course Contents **Hours**

Unit I **A. Introduction to Machine Design** **6**

Concept of machine design, basic procedure of design of machine elements, use of standards in design

B. Engineering Materials

Review and selection of various engineering material properties, factors governing selection of engineering materials, BIS designation of steels, Alloying elements in steels and effects and application

C. General Three-Dimensional Stress

Cartesian stress components, 3D-stress tensor, 2D- stress tensor, Plane stress, plane strain, obtaining principal stresses at a point from stress tensor

Unit II **Design for Static Load** **7**

Types of loads, failure, factor of safety- its selection and significance, theories of elastic failure and their applications (for brittle and ductile material, even, uneven material)

Design of knuckle joint, design of cotter joint, design of levers

Unit III **Design for Fluctuating Load** **6**

Introduction to fatigue in metals, mechanism of fatigue failure (crack initiation stage, propagation stage, fracture stage), fatigue failure models (stress life, strain life, LEFM approach), endurance limit, endurance limit modifying factors. stress concentration and notch sensitivity, fluctuating stresses, S-N diagram under fatigue load, design for finite and infinite life under reversed stresses, cumulative damage in fatigue failure, Soderberg and Goodman diagrams, Modified Goodman diagram

Unit IV **Design of Threaded, Welded, Riveted Joints** **7**

A. Threaded Joints

Basic types of screw fastening, terminology of screw threads, bolted joint-simple analysis, eccentrically loaded bolted joints in shear, eccentric load perpendicular to axis of bolt, design of turnbuckle, elastic analysis of bolted joint, bolted joint under fluctuating load

B. Welded Joints

Welding symbols, butt and fillet welds, strength of butt welds, parallel and transverse fillet welds, eccentric load in the plane of welds, welded joints subjected to bending moment, welded joint subjected to fluctuating forces

C. Riveted Joints

Types of riveted joint, failures of a riveted joint, riveted joint with eccentric load

Unit V	**Design of Springs**	**6**

Types of springs and their applications, styles of end, design of helical compression spring subjected to static loading (stresses in helical springs, the curvature effect, deflection of helical springs), leaf springs, design against fluctuating load

Unit VI	**Design of Power Screw**	**8**

Forms of threads, terminology of threads, torque requirement (lifting and lowering load) self locking and overhauling properties, efficiency of square threaded, self locking screw, trapezoidal and acme thread, collar friction torque, design of power screw and nuts, introduction to recirculating ball screw

Tutorials

Teaching assessment of 10 marks will be based on the completion of following assignments/ group projects

1. Problems on selection of materials, stress tensor
2. Problems on selection of factor of safety and failure theories
3. Problems on knuckle joint, cotter joint, levers
4. Problems on fatigue loading/ experiment on fatigue testing
5. Problems on bolted joints welded joint and riveted joint
6. Problems on spring design
7. Group project- selection of bolts for applications like street light poles , wind turbine, etc.
8. MATLAB Programs for : Obtaining Principal stresses from stress tensor
   Calculating factor of safety using different failure theories

Course Outcome (CO):

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

1. Explain the functions and apply design procedure of various machine elements
2. Select suitable materials, failure theory for designing a machine element.
3. Calculate stresses in a machine element subjected to static loading and determine its dimensions
4. Calculate stresses in a machine element subjected to variable loading and determine its dimensions and estimate its life

Text Books:

1. "Design of Machine Elements", V.B.Bhandari., Tata McGraw Hill Publication, 3rd Edition
2. "Design of Machine Element", J.F. Shigley, Tata McGraw Hill Publication, 9th Edition
3. "Machine Design An Integrated Approach", R.L Norton, Pearson Education Publication, 3rd Edition
4. "Introduction to Machine design",V.B. Bhandari, Tata McGraw Hill Publication, 2nd Edition

References:

1. "Machine Design", Hall, Holowenko Laughlin, Tata McGraw Hill Publication Schaum's Outline Series
2. "Machine Component Design", Robert C. Juvniall, Willey Ltd., 5th Edition
3. "Design of Machine Elements" M.F.Spotts, Pearson Education Publication, 5th Edition

Useful Links: Selected topics from:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-72-elements-of-mechanical-design-spring-2009/lecture-notes/
2. http://nptel.ac.in/courses/112105124/

Mapping of COs with POs (a to l) and PSOs (m, n, o)

Programme Outcomes a.nd Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1			✓	✓	✓		✓			✓					
CO 2						✓		✓			✓				✓
CO 3	✓		✓		✓				✓						
CO 4	✓		✓		✓				✓						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	08
Understand	4	4	1	16
Apply	4	4	3	12
Analyze	2	2	3	08
Evaluate	2	2	2	08
Create	1	1	1	08
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME505: Manufacturing Engineering

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

Course Objectives

1. To familiarize students to the theory of metal cutting, including the process, measurements, selection of various cutting tools and their industrial specifications.
2. Introduce the students to design practices of tooling's (Jigs and Fixtures) and die design for presswork.
3. Study operation planning sheet for various jobs involving different machine tools.
4. Study of various aspects of CNC machine technology and its tooling.

Course Contents **Hours**

Unit I **Theory of Metal Cutting**

Wedge action, speed, feed, depth of cut orthogonal and oblique cutting, mechanics of metal cutting and chip formation, types of chips, cutting ratio, shear plane and shear angle, velocity relationships, force measurement by tool dynamometer, Merchant Circle **07**

Machinability - Concept of machinability, factors affecting such as speed, feed, depth of cut, tool material, angles, work material, machinability index

Unit II **Tool Life, Tool Materials and Tool Geometry** **07**

Tool Life - Types of wear, flank and crater wear, relationship and effect of cutting parameter, Taylor's equation VT^n, improvement measure, surface finish (μR_a) - factors affecting, effect of cutting parameters, improvement, heat generation in machining, its effect on cutting force, tool life and surface finish, Texture of surface finish in different applications and distinction between μR_a, μR_t, μR_ztypes and selection criteria of cutting fluids

Cutting tool materials

High Speed Steel (HSS), carbide coated, (TiC / TiN), ceramics, cermets, Cubic Boron Nitride (CBN), diamond, properties of tool material

Tool geometry - Tool geometry of single point cutting tool, nomenclature for single point cutting tool, tipped tool, types and specification of carbide inserts and tool holders, tool geometry of multi-point cutting tools, viz., drills, milling cutters, reamers

Unit III **Process Planning** **06**

Introduction and steps in process planning, part drawing interpretation, raw material evaluation (cast/forged/bar stock), process selection, selection of machine, tools, preparation of process sheet along with process picture for machining component based on production (job/batch/mass) using conventional and CNC machines (for detailed case study select specific shape and size of component for example - pulley, flange coupling, connecting rod, two-wheeler cylinder block, break drum, gear shaft, etc.)

time estimation-calculation of standard time for above machining process and production rate for various machining operations (exercises expected)

Unit IV **Press Tools** **06**

Principle of metal cutting in press working, presses and their types, press operations like punching, blanking, trimming, etc., die, punch, press working terminology, types of dies, calculation of strip layout, press capacity, centre of pressure, design considerations for die elements (theoretical treatment only)

Unit V **Drilling Jigs and Milling Fixtures** **08**

Application, basic principle, types of locating, clamping and indexing elements, auxiliary elements like tennon, setting block, jig bushes, etc. types of drilling jigs and milling fixtures - design consideration of jigs and fixtures with respect to different operations, introduction to modular fixtures and Computer Aided Fixture Designing (CAFD)

Unit VI **Cost Estimation** **06**

Definition, purpose of cost estimation, difference between cost accounting and cost estimation, types of costs, direct cost, indirect cost, fixed cost, variable cost, elements of cost, material, labour, expenses, factory, selling and distribution, overheads, cost structure, machine hour rate, (case study should be discussed), amortization of tooling cost, steps in cost estimate, breakeven point analysis

Tutorials

Teaching assessment of 10 marks will be based on the completion of following tutorials

1 Study and force measurement on tool dynamometer for turning/milling operation (1mark)
2 Study and force measurement on tool dynamometer for milling /drilling operation. (1mark)
3 Design and drawing of any one drilling jig (2 marks)
4 Design and drawing of any one milling fixture (2 marks)
5 Preparation of process sheet along with process picture for machining component based on production (job/batch/mass) using conventional and CNC machines (for detailed case study for various jobs) (2 marks)
6 Study and demonstration of tools used in CNC machining. (1mark)
7 Industrial visit to study jigs and fixtures, press tools (1mark)
Objectives of industrial visit :
1. Study and understand the different types of jigs and fixtures for various components
2. Study various types of press tools for various components
3. Study of different operations and process sheet and for machined components

Course Outcome (CO):

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

1. Identify single and multipoint cutting tools signature
2. Design jigs and fixtures
3. Understand to draw operation planning sheet for various jobs
4. Select and design dies for press working operations

Text Books:

1. "Text Book of Production Engineering", P.C. Sharma, S. Chand Publication, 11th Edition
2. "Machine Tool Engineering" G.R. Nagarpal, Khanna Publication, 8thEdition
3. Tool Design", Donaldson, THM Publication, 3rd Edition

References:

1. "Production Technology", HMT –Tata McGraw-Hill Publishing Ltd,. ISBN, 0070964432, 9780070964433, (2001)
2. "Fundamentals of Tool Design" ASTME, Prentice-Hall of India Private Ltd., New Delhi Publication, (1976)
3. "Jigs and Fixtures", Kempster, ELBS 3rd Edition

4. “Production Technology”, Thirupati Reddy, Scitech Publication, 1st Edition

Useful Links:

1. http://nptel.ac.in/courses/112105126/

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**B**	**C**	**d**	**E**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1	✓	✓	✓		✓		✓		✓		✓	✓		✓	✓
CO2	✓	✓	✓		✓		✓		✓		✓	✓		✓	✓
CO3	✓		✓						✓		✓	✓		✓	✓
CO4	✓		✓						✓		✓	✓		✓	✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	08
Understand	4	4	1	16
Apply	4	4	3	12
Analyze	2	2	3	08
Evaluate	2	2	2	08
Create	1	1	1	08
Total	15	15	10	60

Government College of Engineering Karad
Third Year B. Tech.
ME 506 Control Engineering Laboratory

Teaching Scheme		Examination Scheme	
Laboratory	2Hrs/week#	**TA/CA**	**25**
Total Credit	1	**ESE**	**25***

Practical to be conducted at alternate weeks

*ESE based on performance in oral examination of combined Control Engineering and Testing and Measurement Lab

Course Objectives:

1. To compare characteristics and responses of control modes for varioussystem gains
2. To identify best suitable PID controller for feedback control system applications
3. To analyze the control engineering problems using MATLAB software
4. To simulate linear physical control system to different excitations

Course Contents

Term work should consist of any 07 experiments from the following

Experiment 1	Study of response characteristics of on-off Controller for fluid flow/ thermal system
Experiment 2	Study of various control modes like P, I, D, PD, PI, PID for pressure / thermal / flow level system
Experiment 3	Study of PID control of single DOF of spring-mass-damper system
Experiment 4	MATLAB programming for generation of transfer function and block diagram reduction
Experiment 5	Using MATLAB, transient response and system performance of linear system to different inputs
Experiment 6	MATLAB programming for pole-zero pattern and system stability
Experiment 7	MATLAB programming for state space method and frequency response method
Experiment 8	Modeling of any physical system using simulation software MATLAB/SIMULINK
Experiment 9	Industrial visit and report writing to study automatic control system applications

Group Activity : Maximum 3 to 4 students in one group

Detailedsurvey/ collection of literature/case studies related to any one of the Control system application based on Mechanical system, Electrical/Electronic system, Vibration system, Fluid flow system, Thermal system etc. Survey/case studies includes following points-

1. Introduction/relevance
2. Objectives
3. Physical layout
4. Block diagram representation
5. Selection of controller and feedback element
6. Theory/description and specifications of system components
7. Principle of working operation
8. Design calculations/theoretical analysis
9. Concluding remarks/comments

Lab Outcomes:

At the end of course, students will be able to

1. Compare the properties/ characteristics of controllers with modes like P, I, D, PI, PD and PID
2. Select controllers in design and analysis of control engineering applications
3. Describe the input-output differential equation for control components used in feedback control systems
4. Use MATLAB/SIMULINK/SciLab software to formulate the simple control engineering problems

Text Books:

1. "Control Systems Engineering using MATLAB", S. N. Sivanandam, S. N. Deepa, Vikas Publishing House (P) Ltd., 2nd Edition
2. "MATLAB and Simulink-Introduction to Applications", Parth S. Mallick, Scitech Publications (I) Pvt. Ltd, 2nd Edition
3. "Analysis and Design of Control Systems using MATLAB", Rao V. Dukkipati, New Age International Publishers, 1st Edition

References:

1. "Getting Started with MATLAB", Rudra Pratap, Version 6, Oxford University Press, 2nd Edition
2. "Introduction to MATLAB 6", D. M. Ether, D. C. Kuncicky, D. Hull, Pearson Education, 1st Edition
3. "Getting Started with Control System Toolbox", Version 5, The MathWorks

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO1	✓	✓		✓							✓	✓	✓		
LO2	✓	✓	✓	✓	✓						✓	✓	✓		✓
LO3	✓		✓	✓	✓						✓	✓	✓		
LO4	✓		✓	✓	✓				✓		✓	✓	✓		

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Avg.
Task I	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	
CA										

Government College of Engineering Karad
Third Year B. Tech.
ME 507: Dynamics of Machines Laboratory

Teaching Scheme		**Examination Scheme**	
Laboratory	2 Hrs/week	**TA/CA**	**25**
Total Credit	1		

Course Objectives:

1. To determine the balancing of masses of rotating and reciprocating machine elements
2. To understand the principles of gyroscope
3. To determine the moment of inertia of various mechanical systems
4. To understand the vibrational behaviour of systems

Course Contents

Term work should consist of any 10 experiments from the following

Experiment 1	Demonstration and study of the gear box of any four wheelers with respect to types of gear, velocity ratio, type of train, arrangement of gears
Experiment 2	Experiment on torque measurement in epicyclic gear train
Experiment 3	Determination of M. I. using bifilar suspension system
Experiment 4	Determination of M.I. using trifilar suspension system
Experiment 5	Experiment on balancing of rotary masses (static and dynamic)
Experiment 6	Study of balancing of reciprocating masses (draw solution on half imperial size drawing sheets)
Experiment 7	Demonstration of automatic balancer
Experiment 8	Verification of gyroscopic principle and determination of gyroscopic couple
Experiment 9	Demonstration of vibration measuring instruments
Experiment 10	To determine equivalent mass of spring for a spring mass system
Experiment 11	Design of flywheel for IC engine and punch press
Experiment 12	Industrial visit to correlate practical applications of the gearbox, balancing of machine and vibration

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

1. Analyse the gears and gear train for typical power transmission application
2. Comprehend gyroscopic principle and effect of gyroscopic couple
3. Solve the problems on balancing of rotary and reciprocating masses
4. Determine the vibration parameters of different systems

Text Books:

1. "Theory of Machines", Rattan S. S., Tata McGraw Hill, 3rd Edition
2. "Theory of Machines", Sadhu Singh, Pearson Education, 3rd Edition
3. "Theory of Machines", Jagdishlal, Metropolitan Publication, 2nd Edition
4. "Theory of Machines", Ballaney, Khanna Publication, 4th Edition
5. "Theory of Machines", V. P. Singh, Dhanpat Rai Publications, 3rd Edition

References:

1. "Theory of Machines and Mechanisms", Shigley, Tata McGraw Hill, 4th Edition
2. "Theory of machines", Thomas Beven, Pearson Education, 3rd Edition
3. "Mechanism and Machine Theory", Rao, Dukkipati, New Age International, 2ndEdition
4. "Mechanisms and Dynamics of Machines", J.Srinivas, SciTech Publication, 2nd Edition
5. "Kinematics, Dynamics and Design of Machinery", Walidron, Wiley India Publication, 2nd Edition

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**L**	**m**	**n**	**o**
LO1	✓	✓	✓		✓										✓
LO2	✓	✓		✓	✓										
LO3	✓	✓			✓						✓			✓	
LO4	✓	✓	✓	✓	✓										

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	05	
CA													

Government College of Engineering Karad
Third Year B. Tech.
ME 508: Heat and Mass Transfer Laboratory

Teaching Scheme	**Examination Scheme**
Laboratory 02 Hrs/week	**TA/CA 25**
Total Credit 01	**ESE 25***

*ESE based on performance in oral examination

Course Objectives:

1. **Execute**: To understand and execute experiments
2. **Measure**: To understand measuring equipments and apply
3. **Analyse**: Analyse the data from experiment and correlate to basic
4. **Apply**: To apply learning in evaluating heat exchanger performance

Course Contents

To perform any nine of the following experiments and two computer programs for experimental results of other experiments

Experiment 1	Determination of thermal conductivity of insulating powder
Experiment 2	Determination of thermal conductivity of a metal rod
Experiment 3	Determination of thermal resistance and temperature distribution in a composite wall
Experiment 4	Determination of thermal conductivity of insulating material in lagged pipe
Experiment 5	Determination of local and average heat transfer coefficient in natural convection heat transfer from a vertical cylinder
Experiment 6	Determination of heat transfer coefficient under forced convection to air from a hot pipe
Experiment 7	Determination of emissivity of a nonblack surface Determination of Stefan Boltzmann constant
Experiment 8	Determination of critical heat flux Determination of heat transfer coefficient in dropwise and film wise condensation
Experiment 9	Determination of overall heat transfer coefficient and effectiveness in a parallel flow and counter flow heat exchanger
Experiment 10	Study and demonstration of heat pipe
Experiment 11	Performance analysis of extended surfaces
Experiment 12	To prepare two program in C or C++ for experimental results
Experiment 13	Determination of thermal conductivity of insulating powder

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

1. Student will able to interpret results
2. Student will able to set process for experimentation
3. Student will able to understand basics of subject by experience
4. Student will able to compare, select and analyse right mode of heat transfer

Text Books:

1. "Heat Transfer", J. P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition (2007)
2. "Fundamentals of Heat and Mass Transfer", R. C. Sachdeva, Willey Eastern Ltd., 2012
3. "A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman, Hyderabad (2005)
4. "Heat and Mass Transfer", S. C. Arrora and S. Domkoundwar, Dhanpat Rai and Sons, Delhi (2012)

References:

1. "Heat Transfer –A Practical approach", Yunus A . Cengel, Tata McGraw Hill, (2015)
2. "Heat Transfer" Chapman A. J., Tata McGraw Hill Book Company, New York, (1960)

3. “Fundamentals of Heat and Mass Transfer”, Frank P. Incropera, David P. Dewitt, Wiley India, 7th Edition, (2011)

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**	**l**	**m**	**n**	**o**
LO 1	✓	✓		✓	✓		✓	✓		✓	✓		✓		
LO 2	✓	✓		✓	✓		✓	✓	✓	✓	✓			✓	
LO 3	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓
LO 4	✓			✓	✓		✓	✓		✓	✓		✓	✓	✓

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	
CA												

Government College of Engineering Karad
Third Year B. Tech.
ME 509 Testing and Measurement Laboratory

Teaching Scheme		**Examination Scheme**	
Laboratory	02 Hrs/week#	**TA/CA**	25
Total Credit	01	**ESE**	-

Practical to be conducted at alternate weeks

Course Objectives:

1. To achieve familiarity with and experience in the use of commonly available measuring devices and instruments in a various applications
2. To demonstrate basic understanding of the physics behind various transducers, knowledge and hands-on experience using transducers for various measurement parameters
3. To acquire a reasonable level of competence in the design, construction, and execution of advanced measurement technique
4. To know calibration process of different types of measurement systems/devices for engineering measurements

Course Contents

Term work should consist of any 07 experiments from the following

Experiment 1	Study of generalised measurement, types, performance characteristics and calibration of instruments
Experiment 2	Study of various types of transducers in measurement systems
Experiment 3	Measurement/calibration of temperature measuring sensors and transducers
Experiment 4	Measurement / calibration of pressure measuring instruments and sensors
Experiment 5	Measurement of vacuum using McLeod, Thermal conductivity and ionization Gauges.
Experiment 6	Measurement of flow using Water meter, Rotameter and Anemometer
Experiment 7	Measurement of displacement using LVDT
Experiment 8	Force and torque measurement using strain gauges
Experiment 9	Measurement of angular speed using sensors/pickups and stroboscope

Group Activity: Maximum 3 to 4 students in one group

Detailedsurvey of collection literature/case studies related to any one of the Measurement/ Instrumentation system in mechanical, thermal, fluid, electrical, electronic application for parameters like temperature, pressure, vacuum, fluid flow, level, displacement, speed, force, torque, strain etc. Survey/case studies includes following points-

1. Introduction/Relevance
2. Objectives
3. Physical layout
4. Block diagram representation
5. Selection of sensors/transducers and display element
6. Theory/Description and specifications of System Components
7. Principle of working operation
8. Design calculations/theoretical analysis
9. Concluding remarks/comments

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

1. Describe the generalized measurement systems, performance characteristics and calibration of transducers/instruments
2. Select best suitable sensor/transducers in design of measurement systems
3. Analyze the measurement errors for statistical analysis of data and estimation of uncertainty
4. Design experimental methods in multi-disciplinary engineering applications

Text Books:

1. "Mechanical Measurement and Control" D. S. Kumar, Metropolitan Book Co. Pvt. Ltd., New Delhi, 4th Edition, 2007
2. "Instrumentation Measurement and Analysis", B. C. Nakra, K. K. Chaudhry, McGraw Hill, New Delhi, 3rd Edition, 2012
3. "Industrial Control and Instrumentation", W. Bolton, Orient Logman Limited Prentice Hall Publication, 3rd Edition
4. "Industrial Instrumentation and Control", S. K. Singh, Tata McGraw Hill, 2nd Edition, 2005

References:

1. "Mechanical Measurement", Beckwith and Buck, Pearson Education Asia, 5th Edition, 2001
2. "Measurement Systems", DoebelinEmesto, McGraw Hill International Publication Co. New York, 4th Edition, 1990
3. "Industrial Instrumentation", K. Krishnaswamy, S. Vijayachitra, New Age International Publishers, 2nd Edition, 2010
4. "Theory and Design for Mechanical Measurements", Richard S. Figliola, Donald E. Beasley, Wiley India, 1st Edition

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO1		✓		✓							✓	✓	✓		
LO2	✓	✓	✓	✓	✓						✓	✓	✓		✓
LO3	✓	✓	✓	✓	✓						✓	✓	✓		
LO4	✓	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Group Activity	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	
CA											

Government College of Engineering, Karad
Third Year B. Tech.
ME510: CAD-CAM Lab-I

Teaching Scheme		**Examination Scheme**	
Lectures	1 Hrs/week	**CA/TA**	50
Practical	2 Hrs/week		
Total Credits	2		

Course Objectives

1. Improve visualization ability of machine components and assemblies before their actual fabrication through modelling, animation, shading, rendering, lighting and colouring
2. To become familiar with a CNC lathe, VMC and a computer-aided manufacturing software package
3. Able to generate and simulate tool path

Course Contents		**Hours**
Unit I	**Assembly Modelling and Production Drawing** Assembly modelling – Defining relationship between various parts of machine, creation of constraints, and generation of exploded view	**2**
Unit II	**Drafting** Generation of 2-D sketches from parts and assembly 3-D model, appropriate dimensioning and tolerance	**2**
Unit III	**Surface Modelling** Introduction, various commands in surface modelling	**2**
Unit IV	**Introduction to CNC Machine** Numerical Control and Computer Control Machine Tools, Functions of CNC, Components of CNC machine, Automatic tool changer (ATC), Automatic pallet changer(APC)	**2**
Unit V	**Part Programming** Introduction to Coordinate systems, Machine Coordinate System and Workpiece Coordinate System, Motion or position control, manual part programming to generate parts on CNC Lathe, VMC's, HMC's, etc.	**3**
Unit VI	**Computer Aided Manufacturing** Introduction to data exchange formats, integration of CAD/CAM software to generate tool path and simulation using suitable software, CADEM-doNC, MillVIEW, MasterCAM, Esprit or equivalent, FANUC, SIMENS and Allen Bradley Controllers	**3**

List of Experiments

Experiment 1	Assembly with minimum 5 components like crane hook, cross head, fixture, screw jack, universal coupling, etc.
Experiment 2	Surface modelling like mouse, badminton racket, cup, jar, exhaust manifold etc. - 2 Exercises
Experiment 3	Drafting of 3D components and assembly- 2 Exercises
Experiment 4	Part programming for CNC turning centre – 2 Exercises
Experiment 5	Part programming for Vertical Machining Centre – 2 Exercises
Experiment 6	Tool path generation by using suitable CAM software – 2 Exercises

Course Outcome (CO) : At the end of this course, students will be able to

1. Model 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings
2. Do surface modelling

3. Implement CNC programs for turning and milling operations
4. Generate G and M code programme through CAM software

Text Books:

1. "CAD/CAM- Principals and Applications", P.N. Rao, Tata McGraw Hill, 2nd Edition
2. "CAD/CAM/CAE", N.K. Chougule, SciTech Publication, Revised Edition
3. "CAD/CAM Theory and Concepts", Kuldeep Sareen, C. Grewal, S. Chand Publications

References:

1. "Mastering CAD-CAM", Ibrahim Zeid, McGraw-Hill
2. "Catia V5R10: For Engineers and Designers",Michele Chambers, Wiley India Pvt. Ltd

Useful Links:

1. http://catiatutor.com
2. http://nptel.ac.in/courses/106106090/

Submission:

Total no. of experiments: six

Note: Submission of all above assignments should be in electronic format/online (preferably in single CD/DVD for all batches)

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering.	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓	✓							✓		✓	✓			
CO2	✓	✓							✓		✓	✓			
CO3	✓	✓			✓				✓		✓				
CO4		✓			✓				✓		✓				

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Government College of Engineering Karad
Third Year B. Tech.
ME 511- Minor Project

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

Course Objectives:

1. To train the students for team work to realize an engineering task.
2. To practice the steps involved for the selection, execution and reporting of the project.
3. To train the students to apply their engineering knowledge to real life problem solving.

The main aim of this course is to demonstrate the important attributes like critical thinking, creativity, collaborative efforts and communication skills in students. The aim is also to make students aware with the process involved in making product from idea. Not more than **five** students may carry out the minor project together. One supervisor from the department shall be assigned three project batches of the minor project.

The steps involved for completion of minor project includes, but not limited to:

1. Conceptualization of innovative idea through literature and market survey; sight visits; interaction with community or industry, socio-economic survey, etc.
2. Design of product, processes, methods and systems using multidisciplinary knowledge
3. Fabrication of product, development of software, measurement methods, etc.
4. Deployment, implementation and demonstration of project
5. Presentation of project

(For purchase of consumables required for completion of project, every project batch shall receive funding from institute with maximum limit decided by BOM)

Guidelines for Project Selection:

Project work shall be based on any of the following:

1. **Design of any equipment /test setup/product (based on facilities available in college)**

   Example –

   - Design and manufacturing of drilling jig for a component
   - Design and manufacturing of milling fixture for component
   - Design and manufacturing of press tool for component and trials for the same. (1.5 mm M.S. sheet
   - Prototype modelling for 3-4 parts assembly. (Design CAD model for a component / assembly and make it with the help of 3-D printer)
   - Design a model and preparing the cam programming and making of the part with the help of VMC.
   - Making the model of any heat power engineering system
   - Any electromechanical /hydraulic/pneumatic circuit design with PLC for particular application
   - Design and manufacturing pneumatic pick and place unit
   - Design a pattern and make it with 3D printer and pour a casting with the help of AUTO CAST
   - Auto pouring ladle for aluminium foundry
   - Semi automatic gravity die casting machine
   - Analysis for auto component with the help of ANSYS software
   - Energy audit for an industry/hospital/institute (up to 10 kW)

2. **Hardware/numerical or theoretical analysis/review of survey study/research and development work**

   The subject content of the minor project shall be from emerging/thrust areas, topic of current relevance. The completion of work, the submission of the report and assessment should be done at

the end of semester.

Project Report Format:

Project report should be of 15 to 20 pages (typed on A4 size sheets). For standardization of the project reports the following format should be strictly followed.

1. **Page Size:** Trimmed A4
2. **Top Margin:** 1.00 Inch
3. **Bottom Margin:** 1.32 Inches
4. **Left Margin:** 1.5 Inches
5. **Right Margin:** 1.0 Inch
6. **Para Text:** Times New Roman 12 Point Font
7. **Line Spacing:** 1.5 Lines
8. **Page Numbers:** Right Aligned at Footer, Font 12 Point, Times New Roman
9. **Headings:** Times New Roman, 14 Point Bold Face
10. **Certificate:** All students should attach standard format of Certificate as described by the department. Certificate should be awarded to batch and not to individual student. Certificate should have signatures of Guide, Head of Department and Principal/ Director.
11. **Index of Report:**
    a. Title Sheet
    b. Certificate
    c. Acknowledgement
    d. Table of Contents
    e. List of Figures
    f. List of Tables
12. **References:** References should have the following format
    For Books: “Title of Book”, Authors, Publisher, Edition
    For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

List of Submission

1 Working model of the project
2 Project Report
3 Presentation and demonstration of project in exhibition

Course Outcome(CO):

1 Ability to understand community needs
2 Ability to covert idea in to product
3 Ability to work in group
4 Ability to communicate effectively with customers

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering.	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1				✓		✓	✓	✓	✓	✓	✓				
CO2			✓	✓	✓	✓	✓	✓	✓	✓	✓				
CO3			✓	✓	✓	✓	✓	✓	✓						
CO4						✓	✓								

Assessment pattern

The continuous assessment shall be done by the supervisor based on attributes like critical thinking, creativity, collaborative efforts and communication skills in students. The end semester assessment shall be done by external referee one week before the term end. The department shall arrange exhibition (all department will arrange the exhibition on same day) of the minor projects done by students and the referee will judge the project work in accordance with the outcomes of the course by interacting with students and marks will be awarded to individual student. This exhibition will remain open for all students, parents, and other citizens visiting the exhibition.

Government College of Engineering, Karad
Third Year B. Tech.
OE621: Industrial Automation

Teaching Scheme		Examination Scheme	
Lectures	2 Hrs/week	**CT1**	--
Practical	2 Hrs/week	**CT2**	--
Total Credits	3	**TA/CA**	50
		ESE	50*

*ESE based on performance in practical examination

Course Objectives

1. To provide a technical understanding of Automated manufacturing systems and significance of different types of automations viz. fixed, programmable and flexible, etc.
2. To familiarize the students with current developments such as use of PLC and simulation software in the field of automation to cope up with requirements of industry
3. To impart skills of designing, simulating and implementing simple automation systems using computer software

Course Contents **Hours**

Unit I **Introduction** **06**

Automated manufacturing systems, fixed /programmable/ flexible, automation, need of automation, basic elements of automated systems- power, program and control, low cost automation, advanced automation functions, levels of automation, industrial control systems in process and discrete manufacturing industries, continuous and discrete control; computer process control

Unit II **Pneumatics and Hydraulics (Overview)** **06**

A. Pneumatic: Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, applications of pneumatics in automation (explaining the pneumatic circuits)

B. Hydraulics: Pumps and motors- types, characteristics, cylinders, types, typical construction details,valves for control of direction, flow and pressure, applications of hydraulics in automation (explaining the hydraulic circuits)

Unit III **Programmable Logic Controllers (PLC)** **06**

Introduction to Programmable Logic Controllers (PLC)**,** PLC system and components of PLC, input output module, PLC advantages and disadvantages over relays,use of PLC in automation,advantages and disadvantages of programmable automationbasic components and symbols, PLC programming methods, fundamentals of ladder diagram, internal relays, holding contacts, always ON always OFF contacts, nesting of ladders PLC input instructions, outputs, coils, indicators, operational procedures, contact and coil input output

Unit IV **Automation using PLC** **06**

PLC sequential function and its applications such as water level control, material handling device, stamping device, elevator, etc., PLC timers and industrial applications such as sorting conveyor, bottling plant, etc., PLC counters and its industrial applications such as packaging, automatic vending machine, etc., Use of automation studio software and interface box (input/output interface) in industrial automation

Course Outcome (CO) : At the end of this course, students will be able to

1. Apply knowledge of automation tools and other equipments for manufacturing and assembly

components

2. Select proper type of automation for particular application such as batch production, mass production and assembly lines, etc.
3. Program the PLC as per the requirement of the automation problem and interface the PLC with real-time system for automation
4. Interface the software tool with real-time system using I/O interface for automation

List of Experiments

Students should perform Any 10 experiments given below:

Experiment 1	Exercise on electro pneumatics for sheet bending application
Experiment 2	Exercise on electro pneumatics for press- in and bonding application with time delay
Experiment 3	Exercise on electro hydraulics for press machine with two hand safety control
Experiment 4	Exercise on electro hydraulics for material handling application
Experiment 5	PLC Programming for water level control and its demonstration
Experiment 6	PLC Programming for elevator and its demonstration
Experiment 7	PLC Programming for sorting conveyor and its demonstration
Experiment 8	PLC Programming for bottling plant with counter and its demonstration
Experiment 9	Exercise on Automation Studio software for automation of material handling application.
Experiment 10	Interfacing of Automation Studio software with pneumatics using interface box (Input/output interface)
Experiment 11	Interfacing of Automation Studio software with hydraulics using interface box (Input/output interface)

Text Books:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Groover, Pearson Education, ISBN: 81-7808-511-9, 2nd Edition, 2004
2. "Programmable Logical Controller",John R. Hackworth and Frederick D. Hackworth, Pearson Education, 4th Edition, 2008
3. " Introduction to Hydraulics and Pneumatics", S. Ilango and V. Soundararajan, PHI Learning Pvt. Ltd., 2nd Edition, 2011

References:

1. "Robotics and Industrial Automation", R. K. Rajput, S Chand
2. "Automation and Robotics", Khushdeep Goyal, Deepak Bhandari, S. K. Kataria and Sons Publications, 1st Edition, 2012
3. "Mechatronics", W. Bolton, Pearson Education , 5th Edition, 2011
4. "Programmable Logic Controllers", W. Bolton, Newnes, 4th Edition, 2006

Useful Links:

1. http://nptel.ac.in/courses/108105062/

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓		✓						✓						
CO2			✓	✓	✓						✓				
CO3		✓	✓	✓							✓				
CO4		✓	✓	✓							✓				

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Government College of Engineering, Karad
Third Year B. Tech.
ME602: Industrial Fluid Power

Teaching Scheme		**Examination Scheme**	
Lectures	03 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	03	**TA**	10
		ESE	60
		ESE Duration	2Hrs.30 min.

Course Objectives

1. To describe the knowledge of basics, ISO/JIC symbols and applications of fluid power in various fields of industries
2. To apply physical laws and principles that governs the behaviour of fluid power systems
3. To select basic essential components utilized in various fluid power systems
4. To develop ability to construct, operate, design and analyse the fluid power circuits

Course Contents **Hours**

Unit I **Introduction to Fluid Power** **05**

Classification, general features applications in various fields of engineering, ISO/JIC Symbols, Principle of hydraulic system, Types of hydraulic fluids and their properties, selection of fluid, Energy and Power in Hydraulic Systems, Basic requirement of pneumatic system, comparison between hydraulic and pneumatic system

Unit II **Hydraulic System Elements** **08**

a) Pumps-types-Gear, lobe, screw, vane, piston, selection of pumps, theoretical flow rate, pump performance – efficiencies

b) Hydraulic Cylinders- Types, single acting, double acting, telescopic and tandem, cylinder force, velocity and power, acceleration and deceleration of cylinder loads, load calculations for vertical, horizontal and inclined cylinders, first, second and third –class lever systems

c) Hydraulic Motors-Types, gear, vane and piston, semi-rotary actuators, analysis of a semi-rotary single-vane motor, performance of hydraulic motors- efficiencies

Unit III **Fluid Power Control Valves** **07**

Hydraulic Systems

Direction control valves – Types, check valves, two way, three way, four way, shuttle valves, methods of actuation

Pressure control valves – Types, pressure relief, pressure reducing, unloading, counterbalance, pressure - sequence

flow control valves – types, needle, non-pressure compensated, pressure compensated

b) Principle of pressure control valves, directly operated and pilot operated pressure

Pneumatic Systems

Direction control valves (two way, three way, four way), check valves, flow control valves, pressure control valves, speed regulators, quick exhaust valves, time delay valve, shuttle valve and twin pressure valve, Solenoid operated, pilot operated valves

Unit IV **Fluid Power Systems Accessories** **06**

Hydraulic Systems

Seals- Classification, reservoirs-types and sizing, Accumulators- types, selection, sizing accumulators, applications, fluid conditioners, filters and strainers, heat exchangers, hydraulic lines-sizing, burst and working pressure

Pneumatic Systems

Compressors- Types, piston, screw and vane, air capacity rating of compressors, power required to drive compressors, sizing of air receivers, Fluid conditioners- air filters, air pressure regulators, air lubricators, FRL unit, air dryers

Unit V **Basic Fluid Power Circuits** **07**

Hydraulic Systems

1. Control of a single acting hydraulic cylinder
2. Control of a double acting hydraulic cylinder
3. Regenerative cylinder circuit
4. Pump-unloading circuit
5. Double-pump hydraulic system
6. Counterbalance application
7. Hydraulic cylinder sequencing circuits
8. Automatic cylinder reciprocating system
9. Locked cylinder using pilot check valves
10. Cylinder synchronizing circuits
11. Speed control of hydraulic cylinder/motor
12. Circuit for fast approach and slow die closing
13. Rapid traverse and feed, alternate circuit

Pneumatic Systems

1. Manual control of single acting and double acting cylinder
2. Unidirectional and bi-directional speed control single acting cylinder
3. OR control of single acting cylinder
4. AND control of single acting cylinder
5. NOT control of single acting cylinder
6. Bidirectional speed control of a double-acting cylinder
7. Unidirectional and quick return of a double-acting cylinder
8. Pneumatic circuit with time delay

Unit VI **Hydraulic Circuit Design and Analysis** **07**

Design of hydraulic system for industrial applications includes following

1. Load, Pressure and flow calculations
2. Sizing and selection of components
3. Design constraints considerations
4. Circuit preparation
5. Energy losses in systems

Course Outcome (CO):

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

1. Understand the basic laws, principle, operation and applications of fluid power systems
2. Select the proper hydraulic or pneumatic component for a specific fluid power application
3. Interpret any hydraulic and pneumatic application circuits with practice of symbols and ISO/JIC standards
4. Develop and design basic fluid power and control circuit related to industrial applications

Text Books:

1. "Oil hydraulics Systems", S. R. Mujumdar, Tata McGraw Hill Publication, 1st Edition, 2005
2. "Pneumatic Systems", S. R. Mujumdar, Tata McGraw Hill Publication, 1st Edition, 2005
3. "Fluid Power with Applications", Anthony Esposito, Prentice-Hall India Publication, 6th Edition
4. "Pneumatic Controls", Joji P., Wiley India , 1st Edition, 2009
5. "Fluid Power", Jagadeesha T., Wiley Publications, 1st Edition, 2013

References:

1. "Hydraulic and Pneumatic", H. L. Stewart, Industrial Press
2. "Industrial Hydraulic", J. J. Pipenger, Tata McGraw Hill
3. "Introduction to Hydraulic and Pneumatics", S. Ilango and V.Soundararajan, Prentice Hall of India, 2nd Edition
4. "Hydraulics and Pneumatics Workshops User's Guide", Automation Studio 5.7, Latest Edition, 2013

Useful Links:

1. www.fluidpowerworld.com
2. www.nfpa.com
3. www.ifps.org/docs/certification/.../fluid power
4. www.ifps.org
5. https://www.jstage.jst.go.jp/browse/jfpsij

Mapping of COs with POs (a to l) and PSOs (m,n,o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,scienc eand engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓			✓					✓		✓				✓
CO2	✓	✓	✓	✓	✓				✓		✓	✓	✓		✓
CO3	✓		✓	✓							✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓						✓	✓	✓		✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	5	1	14
Understand	3	4	2	16
Apply	4	2	3	08
Analyze	3	2	2	10
Evaluate	2	2	1	12
Create	0	0	1	00
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME603:Metrology and Quality Control

Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		ESE Duration	2Hrs.30 min.

Course Objectives

1. To explain and demonstrate working principle, construction of measuring instruments and comparators
2. To explain IS limit system and gauge design
3. Explain and perform inspection of geometrical parameters according to a drawing
4. To explain quality control and quality assurance concept
5. To explain use of control charts and sampling plans in industry

Course Contents **Hours**

Unit I **Introduction** **08**

Need of metrology, precision, accuracy, methods and errors in measurement, calibration

Linear Measurements

International standards of length, line and end measurement, characteristics of measuring instruments, slip gauges.

Angular Measurement

Bevel protractor, spirit level, angle gauges, sine bar, sine centre, angle dekkor, auto collimator, standard balls and rollers for angle measurement

Unit II **Limits, Fits and Tolerances** **09**

Importance of limits system in mass production, IS specifications of limits, unilateral and bilateral tolerances, cost-tolerance relationship, types of fits (including numerical), types of assembly

Limit Gauges

Importance of limit gauging, types, Taylor's principle, design of plug and ring limit gauges (including numerical), three types of limit gauges

Comparators

Need for comparator, Principle of operation, its uses in inspection and characteristics of

i. Mechanical (dial indicator, sigma comparator)
ii. Optical (optical profile projector, Toolmaker's microscope)
iii. Electrical comparator
iv. Pneumatic comparator

Interferometry

Principle of interferometry and application for checking flatness

Unit III **Geometric parameters** **08**

Geometric characteristics of **form** (straightness, flatness, roundness, cylindricity), **orientation** (parallelism, perpendicularity, angularity), **location** (position, concentricity, coaxiality, symmetry) and **run-out** (circular run-out, total run-out) (ISO-1101)

CMM Machine

Principle of Coordinate Measuring Machines (CMM), different configurations of CMM, error involved, calibration, probing system, automated inspection system

Unit IV **Surface Roughness** **09**

Components of surface textures, numerical assessment of surface roughness, surface finish symbols, sampling length, grades of roughness, instruments used in surface roughness assessment (Tomlinson surface meter, Mitutoyo surface roughness tester)

Measurement of Screw Threads

Screw thread terminology, measurement of forms of thread with profile projector, pitch measurement, measurement of thread diameters with standard wire, screw thread micrometer, different errors in screw threads

Gears

Measurement of tooth thickness measurement, run out checking, pitch measurement, profile checking, backlash checking, alignment checking, checking of composite errors, errors in gears

Unit V **Quality Control** **08**

Concept of quality, role of quality, Deming's approach, Juran's approach, quality control and quality assurance, specification of quality, factors controlling quality of design and conformance, cost of quality, balance between cost and quality and value of quality

Quality Assurance

Seven QC tools, Quality Circles, Kaizen, six sigma, 5S system,
Introduction to Business Process Reengineering (BPR)

ISO Standards

Importance and overview of ISO 9000- 1998 series standards, structure of ISO 9000-2000 Series standards, clauses of ISO 9000 series standards and their interpretation and implementation, quality system documentation and audit

ISO 14000

Environmental management concepts, and requirement of ISO 14001, benefits of environmental management systems

ISO/TS 16949

Unit VI **Statistical Quality Control** **08**

Importance of statistical method in quality control, ND curve, Control charts- Attribute (P, nP, C, U) and variable (X bar, R chart and X and R chart), their constructions, interpretation and applications, process capability index (C_p, C_{pk}), methods of determining C_p and C_{pk}

Acceptance Sampling

Basic concept of sampling inspection, operating characteristic curves (OC curve), conflicting interests of consumer and producer, producer and consumers risks, single and double sampling plans

Design of experiment

Meaning, objective, and Taguchi Method, selection of orthogonal array, introduction to failure modes and effects analysis (FMEA)

Course Outcome (CO):

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

1. State the principle, working and characteristics of linear measurement, angular measurement, interferometry, surface roughness, screw thread measurement, gear measurement
2. Use different types of measuring instruments to dimensionally inspect given drawing
3. Differentiate between quality assurance and quality control and analyze the cause of variation to suggest corrective action
4. Formulate quality control charts for manufacturing process and comment on stability of process

Text Books:

1. "Engineering Metrology", I. C. Gupta, Dhanpat Rai Publications, 7th Edition
2. "Engineering Metrology", R. K. Jain, Khanna Publications, 17th Edition
3. "Statistical Methods", S. P. Gupta, Danpat Rai and Sons, New Delhi, 2007

References:

1. "Engineering Metrology and Measurements", N. V. Raghvendra and L. Krishnamurthy, Oxford publication, 2013 Edition
2. "Practical Engineering Metrology", Sharp K.W.B., Pitman, London, 1966
3. "Statistical Quality Control", A. L. Grant, Tata McGraw Hill International, New York. 6th Edition
4. "Statistical Quality Control", R. C. Gupta, 9th Edition
5. "Engineering Metrology", Hume K. G., M. C. Donald, Technical and Scientific, London, 2nd Ed.

6. "Quality Control and Industrial Statistics", Duncon A. J., Publisher- R. D. Irwin, 4th Edition

Useful Links:

1. **NPTEL Lecture:**
   http://www.nptelvideos.in/2012/12/mechanical-measurements-and-metrology.html
2. **Video of Metrology:**
   https://cosmolearning.org/courses/mechanical-measurements-and-metrology/
   ISO-1101 Link:
   https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&v
   d=0ahUKEwjO6bDA1YLRAhWJP48KHT-
   2A2AQFggZMAA&url=http%3A%2F%2Fwww.mh.ttu.ee%2Fpriitp%2FMasinaelemendid%2
   isamaterjalid%2FISO1101.pdf&usg=AFQjCNGsJZ7qwrMzt8zbOwLwYTXLaufwHg&sig2=oz
   JpzOSv_u49ATkOZJoeQ&bvm=bv.142059868,d.c2I

Mapping of COs with POs (a to l) and PSOs (m, n, o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,scienc e and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1	✓	✓		✓					✓			✓			
CO2	✓	✓	✓						✓						
CO3			✓	✓							✓				
CO4	✓	✓	✓	✓	✓				✓			✓		✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	1	08
Understand	4	4	1	16
Apply	3	*3*	3	12
Analyze	2	2	3	08
Evaluate	2	2	2	08
Create	2	2	1	08
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME604: Internal Combustion Engines

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60
		ESE Duration	2 Hrs.30 min.

Course Objectives

1. Study constructional details and various types of internal combustion engine
2. Understand and analyze thermodynamic cycles of I. C. engines
3. Understand combustion phenomenon in S. I. engine and C. I. engines
4. Impart knowledge about various systems on the I. C. engines
5. Impart knowledge about various engine performance characteristics and its testing

Course Contents **Hours**

Unit I **Introduction** **5**

Introduction to I. C. engine, valve timing diagrams, port timing diagrams, selection of I. C. engine for different applications, engine specifications

I. C. engine cycles: Air standard cycles- Auto, diesel and dual cycle, fuel-air cycles, assumptions, actual cycles- Time loss, heat loss and exhaust blow down losses

Unit II **S. I. Engines** **8**

A. Fuel Systems for S.I. Engines:

Engine fuel requirements, complete carburettor, derivation for calculation of A/F ratio, calculation of main dimensions of carburettors, effect of altitude. electronic petrol injection systems types of MPFI systems and their applications, components such as sensors, ECU etc., merits and demerits

B. Combustion in S. I. Engines:

Stages of combustion in S. I. engine – Ignition lag, propagation of flame and afterburning, factors affecting flame speed, abnormal combustion, influence of engine design and operating variables on detonation, fuel rating, Octane number, fuel additives, HUCR, combustion chambers of S.I. engines and its types

Unit III **C. I. Engines** **8**

A. Fuel Systems for C.I. Engines:

Requirements of injection system, types of injection systems – Individual pump, common rail and distributor systems, unit injector, Types of fuel nozzles- single hole, multi hole, pintle, and pintaux, formation of spray, atomization and penetration. Electronic diesel injection system – calculations of main dimension of fuel injection system

B. Combustion in C.I. Engines:

Stages of combustion in C. I. engine, delay period, factors affecting delay period, abnormal combustion- diesel knock, influence of engine design and operating variables on diesel knock, comparison of abnormal combustion in S.I. and C.I. engines, Cetane number, additives, requirements of combustion chambers for C.I. engines and its types

Unit IV **Performance Testing of Engines** **6**

Determination of fuel consumption, air consumption, air-fuel ratio, torque, brake power, indicated power, friction power, brake thermal efficiency, mechanical efficiency, volumetric efficiency and mean effective pressure. numerical on Heat balance sheet, engine performance and performance curves

Unit V **Engine Emission and Control** **7**

S. I. engine emission (HC, CO, NOx) control methods- Evaporative Loss Control

Device (ELCD), catalytic converters, C. I. engines emission (HC, CO, NOx, smog, particulate), control methods- chemical, EGR, standard pollution norms like EURO, Bharat stage-IV, alternative fuels, dual-fuel engines, introduction to supercharging and Turbo-charging

Unit VI **Modern Trends in I. C. Engines** **6**

Advances in valve and valve mechanism e.g. camless engine, variable valve Timing (VVT), advances in S. I. engines: gasoline direct injection system (GDI) components such as sensors, ECU etc., merits and demerits, fuel supply system for LPG/CNG fuels and engines. recent trends in ignition system e.g. Digital Twin Spark Ignition (DTSI), advances in C. I. engines: Common Rail Direct Injection System (CRDI) components such as sensors, ECU etc., merits and demerits

Course Outcome (CO):

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

1. Perform analysis of engine cycles for air standard, fuel-air and real conditions
2. Demonstrate and compare engine systems
3. Analyse engine performance parameters such as torque, brake power, mechanical efficiency, thermal efficiency and specific fuel consumption
4. Apply combustion fundamentals to interpret engine performance
5. Demonstrate knowledge about the engine pollutants, its measurements and modern trends in the engines

Text Books:

1. "Internal Combustion Engines", V. Ganesan, Tata McGraw-Hill Publishing Company Ltd, Fourth Edition, 2013
2. "A Course in Internal Combustion Engines", M. L. Mathur and R. P. Sharma, Dhanpat Rai Publications Pvt. Ltd, First Edition, Re-print 2003
3. "Internal Combustion Engines", Rajput R. K., Laxmi Publications Pvt. Ltd, First Edition, Re-print 2014

References:

1. "Internal Combustion Engines and Air Pollution", R. Yadav, Central Publishing House, Allahabad, Second Edition, 2004
2. "Internal Combustion Engine Fundamentals", John B. Heywood, Tata McGraw-Hill. Publishing Company Ltd, First Edition, 2011
3. "Automotive Engines",Srinivasan, Tata McGraw-Hill Publishing Company Ltd., First Edition, 2001
4. "Internal Combustion Engines", Domkundwar and Domkundwar,Dhanpat Rai Publications Pvt. Ltd. First Edition, 2002

Useful Links:

1. http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/internal_combusn_engines.htm
2. http://vwts.ru/injector/k-jetronic/gasoline_fuel_injection_system_k-jetronic_eng.pdf
3. www.yildiz.edu.tr/~sandalci/dersnotu/AKTraining.pdf
4. www.dieselclass.com/Fuels%20Files/Chapter%2019%20-%20Common%20Rail.pdf
5. http://www.sciencedirect.com/science/book/9781782421832
6. http://www.sciencedirect.com/science/book/9780120597901

Mapping of Cos with POs (a to l) and PSOs (m, n, o)

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**L**	**m**	**n**	**o**
CO1	✓				✓				✓						
CO2	✓	✓			✓				✓						
CO3	✓	✓	✓		✓				✓						
CO4	✓	✓	✓		✓				✓						
CO5	✓	✓	✓		✓	✓		✓	✓	✓	✓				

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1	0	10
Understand	4	4	1	14
Apply	4	4	3	14
Analyze	3	3	3	12
Evaluate	2	2	2	08
Create	1	1	1	02
Total	15	15	10	60

Government College of Engineering, Karad
Third Year B. Tech.
ME605: Machine Design – II

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60
		ESE Duration	2Hrs.30 min.

Course Objectives

1. Familiarize students with design procedure of various transmission elements
2. Design and selection of transmission elements subjected to static and variable loading
3. To learn use of manufacturer's catalogues and design data book
4. Study effect of friction, wear considerations and their relevance to design

Course Contents **Hours**

Unit I **Design of Shaft, Keys, and Couplings** **6**

Design of solid and hollow shafts based on strength and rigidity, ASME code for shaft design, types and design of keys, types and applications of couplings, design of muff, rigid coupling, flexible bushed pin type flanged coupling

Unit II **Design calculations for selection of Belts, Ropes and Chains** **6**

A. Belt drives

Types and construction of belts, selection of flat belt and V belt from manufacturer's catalogue, pulleys for flat and V belts, ribbed V belts

B. Chain Drives

Chain drives, roller chains, geometrical relationships, polygonal effect, power rating of roller chains, sprocket wheels, design of chain drive, chain lubrication

C. Rope Drives

Construction and lay of wire rope, stresses in wire rope, rope sheaves and drums

Unit III **Design of Clutches and Brakes** **6**

A. Clutches

Types, single plate and multi disk clutch , torque transmitting capacity, cone clutches, centrifugal clutches, friction materials, energy equation, thermal considerations

B. Brakes

Energy equation, types, block brake with short and long shoe, pivoted block brake with long shoe,band brakes, internal expanding brakes

Unit IV **Design calculation for selection of Bearings** **8**

A. Rolling Contact Bearing

Tribological consideration, types of rolling contact bearings, static and dynamic load carrying capacities, Stribeck's equation, bearing life, selection of bearing from manufactures catalogue, design for cyclic load and speed, bearings with probability of survival other than 90%,needle bearings, bearing failure, mounting and enclosure

B. Sliding Contact Bearing

Basic modes of lubrication, Petroff's equation, Mckee's investigation, hydrostatic step bearing, Reynolds's equation, Raimondi and Boyd method relating bearing variables, temperature rise bearing design-selection of parameters, bearing construction and material, selection of lubricants and additives, bearing failure-causes and remedies
Comparison of sliding and rolling contact bearing

Unit V **Design of Spur and Helical gears** **7**

A. Spur Gear

Gear tooth failures, selection of materials, gear blank design, beam and wear strength of gear tooth, effective load on gear tooth, estimation of module based on beam and wear strength

B. Helical Gears

Terminology, tooth proportions, virtual number of teeth, force analysis, beam and wear strength of helical gears

Unit VI **Design of Bevel and Worm gear** **7**

A. Bevel Gear

Terminology, force analysis, beam and wear strength of bevel gears, effective load on gear tooth

B. Worm Gears

Terminology, proportions, force analysis, friction in worm gears, selection of materials, strength and wear rating of worm gears, thermal considerations, failure modes and its relation to material selection and occurrence in manufacturing

Course Outcome (CO) : At the end of this course, students will be able to

1. Explain functions and design procedure of various transmission elements
2. Choose an appropriate transmission element for given application
3. Select transmission elements from manufacturers catalogue
4. Calculate stresses in a transmission element subjected to static, variable loading and determine its dimensions

Text Books:

1. "Design of Machine Elements",V.B. Bhandari, Tata McGraw Hill Publication, 3rdEdition
2. "Design of Machine Element", J.F. Shigley, Tata McGraw Hill Publication,9thEdition
3. "Machine Design An Integrated Approach", R.L. Norton, Pearson Education Publication, 3rdEdition

References:

1. "Machine Design",Hall, Holowenko Laughlin, Tata McGraw Hill PublicationSchaum's Outline Series
2. "Machine Component Design", Robert C. Juvniall, Willey Ltd, 5thEdition
3. "Design of Machine Elements" M.F.Spotts, Pearson Education Publication, 5thEdition
4. PSG Design Data Book and Bearing Catalogue

Useful Links : Selected topics from

1. https://ocw.mit.edu/courses/mechanical-engineering/2-72-elements-of-mechanical-design-spring-2009/lecture-note/
2. http://nptel.ac.in/courses/112106137/

Mapping of COs with POs (a to l) and PSOs (m, n, o)

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**B**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1			✓	✓	✓		✓			✓					
CO 2						✓		✓							✓
CO 3	✓		✓		✓				✓		✓				
CO 4	✓		✓		✓				✓						

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	08
Understand	4	4	1	16
Apply	4	4	3	12
Analyze	2	2	3	08
Evaluate	2	2	2	08
Create	1	1	1	08
Total	15	15	10	60

Government College of Engineering Karad
Third Year B. Tech.
ME 606 Industrial Fluid Power Laboratory

Teaching Scheme		**Examination Scheme**	
Laboratory	2Hrs/week#	**TA/CA**	50
Total Credit	1	**ESA**	**-**

Practical to be conducted at alternate weeks

Course Objectives:

1. To apply knowledge of basic components, ISO/JIC symbols and applications of fluid power in various fields of industries
2. To classify the various fluids and components utilized in modern industrial fluid power systems
3. To develop a measurable degree of competence in the design, construction and operation of fluid power circuits
4. To analyse the fluid power circuits using fluid simulation software

Course Contents

Term work should consist of any 07 experiments from the following

Experiment 1	Demonstration of basic hydraulic and pneumatic system
Experiment 2	Demonstration of different types of control valves used in hydraulic and pneumatic system
Experiment 3	Demonstration of actuators, accumulators, intensifiers and ancillary components used in hydraulic and pneumatic systems
Experiment 4	Preparation of circuits on Hydraulic trainer kit (Minimum 5)
Experiment 5	Preparation of circuits on Pneumatic trainer kit (Minimum 5)
Experiment 6	Preparation of circuits using Fluid Simulation Software (Minimum 2)
Experiment 7	Design of hydraulic / pneumatic system with related components for any one of the industrial applications
Experiment 8	Industrial visits are recommended to study basics, working operation and circuit diagram of pneumatic and hydraulic system applications and their reports

Group Activity: Maximum 3 to 4 students in one group

Detailed survey of collection literature/case studies related to any one of the

i) Hydraulic/pneumatic system application – a) JCB machine, b) dumper
ii) Automobiles – a) Power steering, b) power brakes, c) suspension system, d) hydraulic transmission
iii) Construction equipment's – a) Concrete mixture, b) brick making machine
iv) Machine tools
v) Jig and fixtures
vi) Material handling equipment's
vii) Paper and packaging
viii) Sand/ core molding machine
ix) Pharmaceuticals and medical
x) Plastic and rubber industries
xi) Press tools
xii) Textiles and printing industry
xiii) Agriculture equipments etc.

Survey/case studies includes following points-

1. Introduction/Relevance
2. Objectives

3. Schematic diagram
4. Circuit diagram
5. Selection of components- design considerations
6. Theory/description and specifications of system components
7. Principle of working operation
8. Design calculations/theoretical analysis
9. Concluding remarks/comments

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

1. Interpret any hydraulic and pneumatic application circuits with practice of symbols and ISO/JIC standards
2. Select the suitable hydraulic or pneumatic components for a specific fluid power application
3. Develop and design a simple hydraulic/ pneumatic circuit with known input data and specific conditions
4. Use of Fluid Simulation software to develop the ability to build real circuits and demonstrate the understanding of the theories behind the circuitry

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO1	✓	✓		✓							✓		✓		
LO2	✓	✓	✓	✓	✓						✓	✓	✓		✓
LO3	✓	✓	✓	✓	✓						✓	✓	✓		✓
LO4	✓	✓	✓	✓	✓				✓		✓	✓	✓		

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Group Activity	Avg.
Task I	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	
CA										

Government College of Engineering Karad
Third Year B. Tech.
ME 607: Metrology and Quality Control Laboratory

Teaching Scheme		**Examination Scheme**	
Laboratory	2 Hrs/week	**TA/CA**	**25**
Total Credit	1	**ESE**	**25***

*ESE based on performance in practical oral examination

Course Objectives:

1. To explain use of linear and angular measuring instruments for different components
2. To describe use of various comparator in mass production
3. To explain use of CNC CMM to inspect production drawing in modern metrology
4. To demonstrate and explain screw thread and gear measurement
5. To explain normal distribution curve
6. To explain use of quality control charts and operating characteristic curve in manufacturing process

Course Contents

Term work should consist of any 10experiments from the following (minimum three experiments on quality control)

Experiment 1	Perform linear measurement using various linear measuring instruments
Experiment 2	Perform angle measurement using various angle measuring instruments
Experiment 3	Use of comparators in industry with the help of pneumatic and electro-pneumatic comparator
Experiment 4	Use of optical profile projector for Screw thread measurement and gear tooth profile inspection
Experiment 5	Flatness measurement of a surface with the help of an optical flat
Experiment 6	Use of CNC-CMM and inspection fixtures to inspect dimensions and geometrical parameters of a given drawing
Experiment 7	Measurement of surface roughness with surface tester and measurement of gear tooth thickness with gear tooth vernier caliper
Experiment 8	Screw thread measurement (major, minor and effective diameter) with the help of floating carriage micrometer
Experiment 9	Construct a normal distribution curve by actual measurement
Experiment 10	Calculate process capability indices (C_p, C_{pk}) of a given process by actual measurement
Experiment 11	Apply control charts (attribute charts- P, nP, C, U and variable charts - X bar, R chart and X and R chart) to manufacturing process
Experiment 13	Use of operating characteristics curves for a manufacturing process
Group Activity:	A group of 5 students can select any one group activity given below: • Students should collect drawing of a component from industry and suggest a measuring instrument / method to measure various dimension and geometric parameters in it. • Students should visit a nearby industry and do the process capability calculation for a machine.

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

1. Select and use an appropriate linear, angular measuring instrument and comparator for inspection
2. Perform an inspection on CNC CMM for dimensional and geometrical features

3. Measure surface roughness, screw thread parameter and gear tooth parameter using appropriate instrument.
4. Plot normal distribution curve and control charts for a given manufacturing process

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science, and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO1	✓			✓					✓						
LO2		✓			✓						✓				
LO3	✓	✓			✓						✓	✓		✓	
LO4	✓	✓	✓	✓	✓				✓			✓		✓	

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Group Activity	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	
CA												

Government College of Engineering Karad
Third Year B. Tech.
ME608: Internal Combustion Engines Laboratory

Teaching Scheme		**Examination Scheme**	
Laboratory	2 Hrs/week	**TA/CA**	25
Total Credit	1	**ESE**	25*

*ESE based on performance in practical oral examination

Laboratory Objectives:

1. Classify engine types and identify different components
2. To measure and calculate different performance parameters of the engine and study factors affecting them
3. To plot the distinct operating characteristics curves of I. C. engines
4. To provide a technical understanding of use of computer and advanced tools related with I. C. engines

Course Contents

Term work should consist of any 10 experiments from the following

Experiment 1	Demonstration of constructional detail of I. C. engines by dismantling and assembly
Experiment 2	Demonstration of engine systems: Air intake, exhaust, cooling, lubrication systems
Experiment 3	Demonstration of ignition systems, starting systems
Experiment 4	Demonstration of carburetor and petrol injection system
Experiment 5	Demonstration of fuel injection system of diesel engine
Experiment 6	Experiment on diesel engine to determine variable load performance and heat balance sheet
Experiment 7	Experiment on petrol engine to determine variable load performance and heat balance sheet
Experiment 8	Variable speed test on two stroke petrol engine
Experiment 9	Morse test on multi cylinder petrol engine to determine Indicated Power of each cylinder
Experiment 10	Visit to an engine manufacturing company / service station
Experiment 11	Test on computer controlled I. C. Engine to plot pressure versus crank angle (P-θ) diagram
Experiment 12	Measurement of exhaust emissions of S. I. engine/ C. I. engine
Experiment 13	Test on variable compression ratio engine to plot performance curves of engine
Experiment 14	Survey of commercial engines, their specifications, details and troubleshooting

Group Activity:

Trouble shooting of engine components by group of 4 to 6 students

Laboratory Outcomes:

At the end of Laboratory course students will able to,

1. Understand construction and working of various engine systems
2. Perform Testing of Engine and data analysis to draw conclusions
3. Perform engine pollution measurement and its analysis
4. Perform standard performance tests on I. C. Engines using advanced computerized software tools

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	Abilitytoapplyknowledgeofmathematics,science,and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO1	✓			✓					✓						
LO2	✓	✓		✓	✓				✓					✓	
LO3	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓	
LO4	✓	✓		✓	✓				✓		✓			✓	

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Group Activity	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	
CA												

Government College of Engineering Karad
Third Year B. Tech.
ME 609: Machine Design-II Lab

Teaching Scheme **Examination Scheme**
Laboratory 2Hrs/week# **TA/CA** **25**

Total Credit 1

Practical to be conducted at alternate weeks

Course Objectives:

1. Familiarize students with design procedure of various transmission elements.
2. Design transmission elements subjected to static and variable loading
3. To learn use of manufacturers, catalogue
4. Study effect of wear considerations and their relevance to design

Course Contents

Term work should consist of experiments from the following

Project A detail design report and A2 Size sheet containing working drawing of details and assembly of a gear box (i) Spur gear/ Helical gear/Bevel/Worm

Experiment 1 Problems on design of shafts, keys, couplings

Experiment 2 Problems on selection of belts ropes and chains

Experiment 3 Problems on design of clutches and brakes

Experiment 4 Selection, mounting and preloading of ball bearing

Experiment 5 CAD modelling and drafting of couplings, brakes, clutches, etc.

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

1. Explain functions and design procedure of various transmission elements
2. Choose an appropriate transmission element for given application
3. Select transmission elements from manufacturers catalogue
4. Calculate stresses in a transmission element subjected to static, variable loading and determine its dimensions

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	An ability to apply knowledge of mathematics, science and engineering	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Lab Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
LO 1			✓	✓	✓		✓			✓					
LO 2						✓		✓							✓
LO 3	✓		✓		✓				✓		✓				
LO 4	✓		✓		✓				✓						

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Project	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Government College of Engineering Karad
Third Year B. Tech.
ME610: CIM and Workshop Practice- V

Teaching Scheme		Examination Scheme	
Lectures	1 Hrs/week	**CA/TA**	75
Practical	2 Hrs/week	**W/S- V**	25
Total Credits	2	**CIM**	50

At the end, the job assessment will be done for 25 marks by the workshop superintendent and will be submitted to CIM course coordinator.

Course Objectives:

1. To introduce students to the concept of manufacturing automation and factory automation
2. To prepare component using 3D printer and scanner
3. To understand and perform the various machining operations
4. To implement principles of metrology to various components

Course Contents		**Hours**
Unit I	**Group Technology and CAPP:** Relevance of CIM, integration of CAD/CAM and CIM, concept, design and manufacturing attributes, part families, methods of grouping, PFA, different classification and coding systems (OPITZ and MICLASS), relevance of GT in CIM, benefits and limitations Variant and generative approaches to process planning, feature classification and recognition; process classifications and selections, machines and tool selection, setting process parameters, process sheet documentation	**4**
Unit II	**MRP I and MRP II:** Introduction, PPC fundamentals, use of computer in PPC such as MRPI, MRPII	**4**
Unit III	**Flexible Manufacturing Systems:** FMS concept, components of FMS, FMS Layouts, FMS planning and implementation, benefits of FMS, automated material handling system –AGVs, guidance methods, AS/RS. Robot: Robot anatomy, laws of robot, human system and robotics, coordinate system, specifications of robot. power sources, actuators and transducers, robotic sensors, grippers	**4**
Unit IV	**Rapid Prototyping Technologies:** Introduction to rapid prototyping, major RP technologies, viz., SLA (Stereolithography), FDM (Fused Deposition Modeling), SLS (Selective Laser Sintering), Thermo Jet Process, 3D Printing	**4**

Zist of Experiments

Experiment 1	Demonstration of Flexible Manufacturing Cell (FMC) consisting of integration of CNC Lathe, CNC Milling, ASRS, Robot and AGV
Experiment 2	Programming of above systems
Experiment 3	Demonstration, construction and working of 3D printer and to prepare CAD model for 3D printer
Experiment 4	To prepare component from 3D printer by usingCAD model
Experiment	To prepare a scanned model of 3D object using 3D scanner. Use of scanner for Re-

5	engineering
Experiment 6	Demonstration of MRP I and MRP II systems
Experiment 7 (7-12 Turns) Workshop Practice	To manufacture the components as per the drawing requiring at least four of the following operations i. Milling ii. Shaping iii. Grinding iv. Tapping v. Die threading iv. Slotting

Course Outcome (CO):

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

1. Apply classification and coding system in group technology
2. Prepare component using 3D printer and scanner
3. Perform the various machining operations
4. Measure dimensions of various components

Text Books

1. "Automation, Production systems and Computer Integrated Manufacturing" by M.P. Groover (PHI) 3rd Edition
2. "Computer Aided Manufacturing", by P. N. Rao, N.K. Tewari and T.K. Kundra, Tata McGraw Hil ISBN 9780074631034, 3rd Edition
3. "CAD/CAM Computer Aided Design and Manufacturing", M. Groover, E. Zimmers, Pearson Publications, ISBN 9788177584165, 5th Edition
4. "Workshop Technology Vol. II" – by Raghuvanshi, Dhanpath Rai and co. (P) Ltd., 9th Edition
5. "Workshop Technology Vol. II "– by Hajara Choudhary, Media Promoters and Publishers, Mumba 10th Edition

Reference Books

1. "Computer Integrated Design and Manufacturing", by Bedworth, Henderson Wolfe (McGraw Hill 4th Edition
2. "Principles of Computer Integrated Manufacturing", by S. Kant Vajpayee (PHI), 2nd Edition
3. "Introduction to Robotics in CIM system ",James A. Rehg, Pearson Education, 3rd Edition.
4. "Workshop practice manual" by V. Venkata Reddy, BS Publications, 6thedition

Useful Links

1. http://nptel.ac.in/courses/112102103/17
2. http://nptel.ac.in/courses/112107077/module5/lecture2/lecture2.pdf

List of Submission

1. Total no. of experiments – 06 and one component to be manufactured by each student for Work Shop practice –V.

Mapping of LOs with and POs and PSOs

Programme Outcomes and Programme Specific Outcomes	Anabilitytoapplyknowledgeofmathematics,science and engineering.	An ability to design and conduct experiments, as well as to analyze and interpret data	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	An ability to function on multidisciplinary teams	An ability to identify, formulate, and solve engineering problems	An understanding of professional and ethical responsibility	An ability to communicate effectively	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	A recognition of the need for, and an ability to engage in life-long learning	A knowledge of contemporary issues	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	Conduct independent research to solve industrial problems through locating & articulating	An ability to perform basic structural, thermal and fluid flow analysis with conventional and CAE tools, and documentation of results	An ability to operate, test, diagnose faults and maintain equipment, machinery and basic mechanical systems	An ability to select/specify materials, tool, machinery and manufacturing processes for different applications
Course Outcomes	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1	✓						✓			✓	✓				
CO2	✓	✓			✓							✓			
CO3	✓	✓	✓		✓		✓								✓
CO4	✓				✓					✓	✓			✓	

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Avg.
Task I	15	15	15	15	
Task II	05	05	05	05	
Task III	05	05	05	05	
CA					

Government College of Engineering Karad.
Third Year B. Tech
HS003 – General proficiency III

Teaching Scheme		**Examination Scheme**	
Lectures	02 Hrs./week	**CA**	50
Practical	02 Hrs./week		
Total Credits	03		

Course Objectives

1 To understand the different components of selection process i.e. written test, GD & PI.

2 To equip the students with the ability to clear NACTECH, AMCAT & ELITMUS.

3 To develop a thorough understanding of these components through strong conceptual understanding, logical approach with various short cuts & practical techniques for manage speed and accuracy to clear the written test & participation in GD & PI

Course Contents

Hours

Unit I **Soft skills** **10**

The module Corporate Recruitment Training has four different topics that are**:**

- JAM
- Basics of Group Discussion
- Effective Resume' Writing
- Basics of Interview Skills

Unit II **Basic concept 4** **8**

The module basic concept 4 has the following topic**:**

- Ratios & proportions
- Partnerships
- Problems on ages
- SI & CI
- Averages
- Clocks & Calendars

Unit III **Logical Reasoning** **8**

The module reasoning has the following topic**:**

- Venn diagrams
- Cubes
- Logical deductions
- Letter series
- Number series

- Odd man out

Unit IV **Basic concepts 5** **6**

The module basic concepts 5 has the following topic**:**

- Number system
- Mensurations
- Probability
- Permutations & combinations

Unit V **Reasoning** **10**

- Reasoning 3
- Reasoning 4
- Data interpretation
- Data sufficiency

Unit VI **Verbal Aptitude Skills** **10**

The module verbal aptitude has the following topics**:**

- Introduction to verbal aptitude & verbal pattern
- Synonyms & antonyms
- Spotting errors & Sentence correction
- Reading comprehension & sentence rearrangement

Note **Delivery Methodology to be followed fully depends on the Skill sets as detailed below.**

Language Skills

- A new methodology of acquiring language which integrates LSRW through emotional connect & experiences in one's life.
- The integrated approach coupled with lot of interaction, group work & effective facilitation leads to overall improvement of one's communication skills

Soft Skills

- Pre & post assessment for each topic
- Comprehensive pre & post assessment capsule wise.
- Explanation of the concept
- Self-assessment inventory
- Activities for experiential learning
- Case studies for better understanding of the concept
- PPTs and videos

Aptitude Skills

- Pre & post assessment

- Explaining the concept
- Multiple approaches to the given problem
- PPTs

Verbal Aptitude Skills

- Pre & post assessment for each topic
- Comprehensive pre & post assessment capsule wise.
- Explanation of the concept
- Work sheet for each topic

References:

1. Understanding organizational Behavior by Uday Parek
2. Training instruments on HRD & OD by Uday Parek & Dr.Surabhi purohit
3. Language Instinct by Steven Pinker
4. Freedom from Imperial shakels by Dr.K.N. Anandan
5. Quantitative Aptitude by R.S. Agarwal
6. Quicker Maths by Tyra & khundan
7. Quantitative Aptitude by Abhijeet Guh

Course Outcomes
After completing this course students will be able:

- To understand different components of campus recruitment drive.
- To effectively present oneself &ideas in JAM ,GD& interview
- To draft a resume effectively and practice the questions asked from resume'
- To learn & practice different components of verbal topics
- To learn different methods in vocabulary building & contextually use them.
- To learn various bridges in analogies
- To learn different techniques & to spot the errors pertaining to various grammatical rules & structures.
- To explaining concepts and sharing different logics for faster computations in different topics of Aptitude and Reasoning.
- The students will be able to identify and use formula as a strategy for solving problems.
- Faster computations
- Identifying most commonly made mistakes and thereby improving upon their accuracy.