An Autonomous Institute

Shree Warana Vibhag Shikshan Mandal's

Tatyasaheb Kore Institute of Engineering And Technology, Warananagar

NBA Accredited Institute

Department of Mechanical Engineering

T. Y. B. Tech. Mechanical Engineering

2022-23

B. Tech. In Mechanical Engineering

Syllabus Structure and Curriculum under Autonomy

SWVSM'S

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

An Autonomous Institute

Abbreviations

Sr.No.	Acronym	Definition
1	ISE	In-Semester Examination
2	ISE-I	In-Semester Examination-I
3	ISE-II	In-Semester Examination-II
4	ESE	End-Semester Examination
5	ISA	In-Semester Assessment (Term Work)
6	L	Lecture
7	T	Tutorial
8	P	Practical
9	CH	Contact Hours
10	C	Credit

Course/ Subject Categories

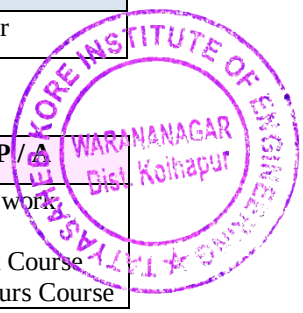
Sr.No.	Acronym	Definition
1	BSC	Basic Science Course
2	HSC	Humanity Science Course
3	ESC	Engineering Science Course
4	PCC	Professional Core Course
5	OEC	Open Elective Course
6	MC	Mandatory Course
7	PEC	Professional Elective Course
8	PW	Project Work (Mini and Major Project)
9	II	Industrial Internship

Course/ Subject Code

M	E	3	0	1
Branch Code		Semester	Course Number	

Course Term work and POE Code

M	E	3	0	1	T/P / A
Branch Code		Semester	Course Number		T- Term work P- POE A- Audit Course H- Honours Course



Tatyasaheb Kore Institute of engineering and Technology, Warananagar
An Autonomous Institute
Department of Mechanical Engineering

❖ Vision

To become an academy of excellence in technical education and human resource development.

❖ Mission

- To develop engineering graduates of high repute with professional ethics.
- To excel in academics and research through innovative techniques.
- To facilitate the employability, entrepreneurship along with social responsibility.
- To collaborate with industries and institutes of national recognition.
- To inculcate lifelong learning and respect for the environment.

❖ Quality Policy

To promote excellence in academic and training activities by inspiring students for becoming competent professionals to cater industrial and social needs.

Tatyasaheb Kore Institute of engineering and Technology, Warananagar
An Autonomous Institute
Department of Mechanical Engineering

PROGRAM EDUCATIONAL OBJECTIVES

Graduates will be able to,

[1] Make successful careers in Indian and multinational companies
[2] Be competent with strong technological background to solve industrial and societal problems
[3] Succeed in a post graduate as well as research programs.
[4] Be sensitive towards professional ethics and environmental issues.
[5] Lead teams for executing multidisciplinary projects

PROGRAM OUTCOMES

After completion of the Program, graduates will have,

[1] An ability to apply knowledge of mathematics, science and engineering fundamentals to solve complex Mechanical engineering problems
[2] An ability to analyze the mechanical problem, interpret data through synthesis and evaluate to make conclusion
[3] Capability to solve complex engineering problems and design system components or processes as per specified requirements addressing public health, safety, cultural, societal and environmental issues
[4] An ability to identify the problems and apply the research methodology to formulate, investigate and validate the outcomes.
[5] An ability to make use of advanced techniques and tools necessary in engineering practices
[6] An ability to understand societal, health, safety, legal and cultural issues while providing solutions for mechanical engineering problems
[7] An ability to develop sustainable solutions and identify with their effects on society and environment
[8] An apply ethical principles and commit to professional ethics and responsibilities of the engineering practice
[9] An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
[10] An ability to comprehend technical ideas, communicate through effective design documentation and oral presentation.
[11] An ability to lead and manage multidisciplinary teams by applying engineering and management principles.
[12] An ability to engage in independent and life - long learning in the broadest context of advancement in technology.

PROGRAM SPECIFIC OUTCOMES

[1] Graduates will be able to model and analyze the machine design problems.
[2] Graduates will be able to demonstrate the working of energy conversion devices.
[3] Graduates will be able to manufacture the products using different machine tools.

ThirdYearB.Tech.InMechanicalEngineering

SyllabusStructureunderAutonomousStatusofTKIET,Warananagar

2022-23

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

ThirdYearB.Tech. (Mechanical Engineering)

Semester-V

(To be implemented from 2022 - 23)

Credit Scheme

Course	Category	Course Title	Teaching and Credit Scheme					Examination & Evaluation Scheme			
			L	T	P	CH	C	Component	Marks	Min for Passing	
ME501	PCC	Theory of Machine– II	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME502	ESC	Heat and Mass Transfer	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME503	PCC	Design of Machine Elements-I	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME504	OEC-I	Industrial Instrumentation and Control / Modeling and Simulation of Manufacturing Systems	2	--	--	2	2	ESE	60	24	40
								ISE	40	16	
ME505	PEC-I	Manufacturing Engineering / Computer Integrated Manufacturing	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME501P	PCC	Theory of Machine– II Lab	--	--	2	2	1	ISA	25	10	20
								POE	25	10	
ME502P	ESC	Heat and Mass Transfer Lab	--	--	2	2	1	ISA	25	10	20
								POE	25	10	
ME503T	PCC	Design of Machine Elements-I Lab	--	--	2	2	1	ISA	25	10	10
ME504T	OEC-I	Industrial Instrumentation and Control / Modeling and Simulation of Manufacturing Systems	--	--	2	2	1	ISA	25	10	10
ME506P	ESC	Arduino Model Making Lab	--	--	2	2	1	ISA	50	20	30
								POE	25	10	
ME507T	PCC	Manufacturing Skill Development Lab-III	--	--	2	2	1	ISA	50	20	20
ME508T	PW	Mini-Project Phase -I	--	--	2	2	1	ISA	25	10	10
ME508A	--	Audit Course - V	--	--	--	--	--	--	--	--	--
			14	0	14	28	21	0	800	320	320

Tatyasaheb Kore Institute of Engineering and Technology, Warananagar

Third Year B. Tech. (Mechanical Engineering)

Semester- VI

(To be implemented from 2022-23)

Credit Scheme

Course	Category	Course Title	Teaching and Credit Scheme					Examination & Evaluation Scheme			
			L	T	P	CH	C	Component	Marks	Min for Passing	
ME601	PEC-II	Industrial Fluid Power/Process Planning and Cost Estimation	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME602	PCC	Metrology and Quality Control	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME603	PCC	Design of Machine Elements–II	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME604	PCC	Internal Combustion Engines	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME605	OEC-II	Industrial Management and Operation Research / Smart Materials	3	--	--	3	3	ESE	60	24	40
								ISE	40	16	
ME601T	PCC	Industrial Fluid Power Lab/Process Planning and Cost Estimation Lab	--	--	2	2	1	ISA	25	10	10
ME602P	PCC	Metrology and Quality Control Lab	--	--	2	2	1	ISA	25	10	20
								POE	25	10	
ME603T	PCC	Design of Machine Elements–II Lab	--	--	2	2	1	ISA	25	10	10
ME604P	PCC	Internal Combustion Engines Lab	--	--	2	2	1	ISA	25	10	20
								POE	25	10	
ME606T	PCC	CAD/CAM and 3D Printing Lab	--	--	2	2	1	ISA	50	20	20
ME607T	II	IndustrialTraining – I	--	--	--	2	1	ISA	50	20	20
ME608T	PW	Mini-Project Phase - II	--	--	2	2	1	ISA	50	20	20
ME609A	--	Audit Course – VI	--	--	--	--	--	--	--	--	--
			15	0	12	29	22	--	800	320	320

Third Year B. Tech. (Mechanical Engineering)

First Semester Detailed Syllabus

ME501-THEORY OF MACHINE-II

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**		**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Understand the basic theory of gears.
2. Analyze the various types of gear trains used for transmission of motion and power.
3. Study the gyroscopic effect on different vehicles, aero plane and ship.
4. Study and analyze the problems on balancing of rotary masses.
5. Study the force analysis of simple mechanisms

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify the various types of gears and gear trains.	Understand
CO2	Study the Dynamic analysis of mechanisms used in various machines .	Knowledge
CO3	Select gear drives for engineering applications to meet the power transmission requirements.	Apply
CO4	Analyze the gyroscopic effects on mechanical rotating Equipments.	Apply Evaluate
CO5	Solve a balancing problems developed in reciprocating and rotating components.	Analyze
CO6	Develop a suitable Flywheel as per Industrial needs .	Create

Description:

This course is designed to provide basic knowledge of mechanism which is necessary for machine development and design. This syllabus covers basic elements of mechanism such as gears, balancing etc. to help students to construct machines.

Prerequisites:	1:	Knowledge of mathematics
	2:	Knowledge of applied mechanics

Section – I		
Unit 1	**Toothed Gearing:**	
	Gear geometry, Types of gear profile- Involute & cycloidal, Theory of Spur gear, Asymmetric gear , Interference in Involute tooth gears and methods for its prevention, Path of contact, Contact ratio	**7 Hrs**
Unit 2	**Gear Trains**	
	Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Tabular method for finding the speeds of elements in epicyclic gear train, Torque in epicyclic gear train, Differential gear box	**6 Hrs**
Unit 3	**Gyroscope**	
	Gyroscopic couple, spinning and Precessional Motion, Gyroscopic couple and its effect on i) Aero plane ii) Ship iii) Two –Wheeler	**7 Hrs**
Section – II		
Unit 4	**Static and dynamic Force analysis of Mechanisms**	
	Velocity and acceleration of slider crank mechanism by analytical method, Inertia force and torque, D ‟Alembert's principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism	**7 Hrs**
Unit 5	**Balancing**	
	Static and Dynamic balancing of rotary masses. Number of masses rotating in single plane and different planes	**6 Hrs**
Unit 6	**Flywheel**	
	Turning moment diagrams, Fluctuation of energy, Coefficient of fluctuation of speed, Rimmed flywheel.	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	1	--	--	--	--	--	--	--	--	--	2	--	--
CO2	1	2	3	--	--	--	--	--	--	--	--	--	3	--	--
CO3	3	1	2	--	--	--	--	--	--	--	--	--	3	--	--
CO4	1	2	3	--	--		--	--	--	--	--	--	2	--	--
CO5	1	-	3	--	--	--	--	--	--	--	--	--	2	--	--
CO6	1	2	3	1	--	--	--	--	--	--	--	--	2	--	--

References:

Text Books	
1	Theory of Machines, Rattan S.S. ,Tata McGraw Hill, Publications.
2	Mechanism and Machine Theory, Rao, Dukkipati, New Age International.
3	Theory of Machines , J. K. Gupta & R. S. Khurmi , S. Chand Publications
Reference Books	
1	Theory Of Machines And Mechanisms, John J. Uicker, Gordon R. Pennock & Joseph E. Shigley, Oxford University Press, 4th Edition.
2	Theory of Machines, Thomas Beven, Pearson Publisher, 3rd Edition.
3	Theory of Mechanisms & Machines, Jagdish Lal, Publisher, Metropolitan Book Company.

ME502- HEAT & MASS TRANSFER

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**		**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Students will learn about basic concept of heat transfer modes, their basic laws of conduction, convection, radiation and combined modes.
2. Students will also learn general theory and mathematic expressions or differential equations for conduction and radiation as well as governing equations of convection so that students can solve real time heat transfer problem.
3. Students will earn about design and analysis of heat exchanger devices by using LMTD and NTU approach.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	State basic modes of heat and mass transfer to formulate basic equations based on fundamental laws	Understand
CO2	Apply electrical analogy of conduction to design and evaluate performance of thermal systems.	Apply
CO3	Estimate rate of heat transfer and other performing parameters under convection and radiation modes.	Apply
CO4	Calculate the effectiveness and rating of heat exchangers to select the appropriate type of heat exchanger for thermal system	Analyze Evaluate
CO5	Identify the impact of boundary conditions on heat transfer problems and to generate mathematical equations for the same.	Analyze Create
CO6	Solve the combine modes heat transfer problem	Evaluate

Description:

In mechanical industries, conversion of heat energy into mechanical energy is prime task to achieve different applications. Therefore, mechanical students should have knowledge of thermodynamics, heat transfer and design of thermal systems. This course is designed to provide knowledge of modes of heat transfer, basic laws, mathematical equations required for analysis and design. It also covers study of combined modes of heat transfer and heat exchangers.

Prerequisites:	1:	Fluid Mechanics
	2:	Basic Thermodynamics
	3:	Engineering Mathematics

Section – I		
Unit 1	**Introduction to Heat and Mass Transfer**	
	Basic concepts: 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 Engg. Materials (Description only), Introduction to mass transfer, Modes of mass transfer, Analogy between heat, mass and momentum transfer, Fick's law of diffusion, Derivation of Generalized differential equation of heat conduction in Cartesian co-ordinates, 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.	**10 Hrs**
Unit 2	**Heat Conduction with Heat Generation and Unsteady State Heat Conduction**	
	One dimensional steady state heat conduction with heat generation: One dimensional steady state heat conduction with uniform heat generation for plane wall; cylinder; and sphere (with numerical on plane wall and cylinder) **One dimensional unsteady state heat conduction:** Lumped Heat capacity Analysis, Biot and Fourier number and their significance, (Numerical based on Lumped Heat capacity Analysis)	**6 Hrs**
Unit 3	**Extended Surfaces**	
	Types and applications of fins, Heat transfer from rectangular and pin fins. Fin effectiveness and efficiency, Analysis of fin with insulated end and infinite long fin, Error estimation in temperature measurement in thermo well (No numerical on error estimation).	**6 Hrs**
Section – II		
Unit 4	**Convection**	
	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. **Natural convection:** Dimensional analysis, Physical significance of	**6 Hrs**

	dimensionless numbers, correlations for natural convection over vertical plate, cylinder, & sphere and flow patterns. **Forced convection:** Dimensional analysis, Physical significance of dimensionless numbers, Reynolds analogy for laminar flow, Correlations for forced convection over flat plate and closed conduits.	
Unit 5	**Radiation**	
	Nature of thermal radiation, absorptivity, reflectivity, transmissivity, emissive power and emissivity, spectral and total concept, blackbody, gray 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 gray 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.	**6 Hrs**
Unit 6	**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	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	3	--	--	--	---	--	--	--	--	--	2	--
CO2	3	2	3	3	--	--	--	--	--	--	--	--	--	2	--
CO3	2	2	2	2	--	--	--	--	--	--	--	--	--	2	--
CO4	3	2	3	3	--	--	--	--	--	--	--	--	--	2	--
CO5	2	3	3	3	--	--	--	--	--	--	--	--	--	3	--
CO6	3	3	2	3	--	--	--	--	--	--	--	--	--	3	--

References:

Text Books	
1	"Heat and Mass Transfer", R.K.Rajput, S. Chand and Company Ltd., New Delhi., 5th Edition
2	"Heat Transfer", J.P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition
3	"Fundamentals of Heat and Mass Transfer", R.C. Sachdeva, Willey Eastern Ltd., New York, 2nd Edition
4	"Heat and Mass transfer", M.M.Rathod, Laxmi Publications
Reference Books	
1	"Heat Transfer – A Practical approach",Yunus. A .Cengel, Tata McGraw Hill
2	"Heat Transfer" Chapman A.J., Tata McGraw Hill Book Company, NewYork
3	"Fundamentals of Heat and Mass Transfer", Frank P.Incropera, David P.Dewitt,Wisley India. 5th Edition
4	"A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman Publication Hyderabad
5	"Heat and Mass Transfer", S.C.Arora and S. Domkundwar, Dhanpat Rai and Sons, Delhi

ME503 – DESIGN OF MACHINE ELEMENTS –I

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	2 Hr/Week	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Study basic principles of machine design.
2. Understand the principles involved in evaluating the dimensions of a mechanical component to satisfy functional and strength requirements.
3. Learn use of catalogues and design data book.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify and apply basic principles of machine design	Knowledge
CO2	Design machine elements on the basis of strength concept.	Understand
CO3	Solve the design problems for various machine elements used in industries	Apply
CO4	Prepare assembly and detail drawings for different machine elements.	Analyze
CO5	Use design data books and standard practices.	Create
CO6	Select machine elements from Manufacturers catalogue by applying standard design criteria.	Evaluate

Description:

The main task of mechanical engineer is to design the mechanical elements as per the requirement to accomplish the objective of task. It is done by the study of this course. It covers principles, theory, and mathematical expressions regarding the design process. By applying the basic principles of machine design students should be able to design the Machine Elements like Knuckle Joint, Turn Buckle, lever, Shaft, Couplings, Welded & Bolted joints, Springs and Belts.

Prerequisites:	1	Engineering Mechanics
	2	Analysis of Mechanical Elements
	3	Theory of Machines -I

Section – I		
Unit 1	**Fundamentals of Machine Design**	
	Concept of Machine design, Types of loads, Factor of safety- its selection and significance, Theories of failure (Maximum Principle stress, Maximum shear stress and Maximum Distortion Energy), Phases of design of machine elements, Review and selection of various engineering material properties and I.S. coding for ferrous materials, Factors governing selection of Engineering materials.	**5 Hrs**
Unit 2	**Design of Mechanical Elements**	
	a) Design of machine elements under static loading- Knuckle joint, Turn buckle and bell crank Lever. (Numerical on Knuckle Joint and Bell crank Lever). b) Forms of threads, Terminology of threads, Trapezoidal and Acme thread, Design of power screw and nuts (Numerical on Power Screw with Square thread).	**8 Hrs**
Unit 3	**Design of Shaft, Keys, and Couplings**	
	Design of solid and hollow shafts, ASME code for shaft design, Splined Shaft (Theory), Types and Design of Keys, Types of Couplings, Design of Rigid flange coupling, Bushed pin type flexible coupling.	**7 Hrs**
Section – II		
Unit 4	**Design of Joints**	
	Design of bolted joints subjected to following conditions- 1) Joints in shear 2) Joints subjected to load perpendicular to the axis of bolt. Design of welded joints- 1) Strength of transverse and parallel fillet welds 2) Eccentric load in the plane of weld (Theoretical Treatment) 3) Welded joint subjected to bending moment. (Theoretical Treatment)	**9 Hrs**
Unit 5	**Design of springs**	
	Types of springs and their applications, Styles of end, Design of Helical Compression Spring subjected to static loading.	**5 Hrs**
Unit 6	**Design of Pulley and Selection of Belts**	
	Design of Pulley- flat and V belt pulley, Selection of flat belt, V belt as per the standard manufacturers catalogue	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	2	--	--	--	---	1	--	--	--	3	--	2
CO2	2	2	2	2	--	--	--	--	1	--	--	--	3	--	2
CO3	2	2	3	2	--	--	--	--	1	--	--	--	3	--	2
CO4	2	2	2	2	--	--	--	- -	1	--	--	--	3	--	2
CO5	2	2	2	2	--	--	--	--	1	--	--	--	3	--	2
CO6	2	2	2	2	--	--	--	--	1	--	--	--	3	--	2

References:

Text Books	
1	"Design of Machine Elements", V. B. Bhandari., Tata McGraw Hill Publication, 3rd Edition.
2	"A Text Book of Machine Design", R.S. Khurmi and J. K. Gupta.
3	"Machine Design", Pandya Shah, Charotar Publication.
4	"Machine Design", U. C. Jindal, Pearson Education.
Reference Books	
1	"Design of Machine Element", J. F. Shigley, Tata McGraw Hill Publication.
2	"Design of Machine Element" M. F. Spotts, Pearson Education Publication, 6th Edition.
3	"Machine Component Design", Robert C. Juvniall, Willey Ltd, 5th Edition.
4	PSG Design data Book, PSG College Coimbatore.

ME504 (OEC-I) INDUSTRIAL INSTRUMENTATION AND CONTROL

Lectures	**:**	2Hrs/Week	**Evaluation Scheme**		
Credit	**:**	2	**ISE**	**:**	40 Marks
			ESE	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Impart knowledge of architecture of the instrument &measurement system
2. Deliver working principle of mechanical measurement system
3. Study concept of mathematical modeling of the control system
4. Acquaint with control system under different time domain

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Classify various types measuring system and their static characteristics and types of errors occurring in the system.	Knowledge Understand
CO2	Classify and select proper measuring instrument for linear and angular displacement, acceleration	Knowledge Apply
CO3	Classify and select proper measuring instrument for pressure and temperature measurement	Understand Apply
CO4	Design mathematical model of system/process for standard input responses	Analyze
CO5	Analyze error and differentiate various types of control systems and time domain specifications	Apply Evaluate
CO6	Analyze the problems associated with root locus stability	Apply

Description:

Instrumentation and control is at the core of all industrial and manufacturing activities. Within a production facility, every process must be carefully monitored and controlled to proceed in a predetermined fashion like optimized and safe. When working with heavy and dangerous equipment, getting accurate measurements can be a very difficult process. This is why instrumentation is so important. Because of the number of processes involved in modern machines, accurate instrumentation and control is needed to ensure that everything is operating properly.

Prerequisites:	1:	Fluid mechanics, Applied physics.
	2:	Electrical technology basic terms.
	3:	Partial Differentiation, Laplace transformation, Differentiation and integration formulae.

Section – I		
Unit 1	**Introduction to Instrumentation**	
	Significance of Mechanical Measurements, Classification of measuring instruments, generalized measurement system Static characteristics: Static calibration, Linearity, Static Sensitivity, Accuracy, Static error, Precision, Reproducibility, Threshold, Resolution, Hysteresis, Drift, Span & Range etc. Errors in measurement, Types of errors.	**3 Hrs**
Unit 2	**Instrumentation I**	
	Displacement Measurement: Potentiometer, LVDT, Strain Measurement: Gauge factor, temperature Compensation, Bridge circuit, orientation of strain gauges for force and torque, Strain gauge based load cells Measurement of Angular Velocity: Tachometers, Stroboscopic Methods. Acceleration Measurement: accelerometer and vibrometers	**6 Hrs**
Unit 3	**Instrumentation II**	
	Pressure Measurement: Bourdon tubes, diaphragm, bellows and piezoelectric pressure sensors, Vacuum measurement: Vacuum gauges by Thermal Conductivity gauges Flow Measurement: Bernoulli flow meters and Rota meter Temperature Measurement: Resistance thermometers, Thermistors and thermocouples, Pyrometers	**6 Hrs**
Section – II		
Unit 4	**Mathematical Model of Control System**	
	Introduction to control systems, Classification of control system. Open loop and closed loop systems. Mathematical Model of Control System, Mechanical Translational Systems, Grounded Chair Representation, Electrical Elements, Analogous Systems, Force – Voltage Analog, Force – Current Analog	**4 Hrs**
Unit 5	**Transient Response**	
	General Form of Transfer Function, Concept of Poles and Zeros, Distinct, Repeated and Complex Zeros. Response of systems to various Inputs (Impulse, Step, Ramp & Sinusoidal). Damping Ratio and Natural Frequency, Transient Response Specification and steady state analysis of first and second order system. Time Domain specifications. Step response of second order system.	**5 Hrs**
Unit 6	**Root Locus**	
	Introduction to concepts of stability, Routh criteria for stability Significance of Root Locus, Construction of Root Loci, General Procedure, Effect of Poles and Zeros on the System Stability analysis using Root locus.	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	--	--	--	--	--	---	1	--	--	--	2	1	--
CO2	1	1	1	--	--	--	--	--	1	--	--	--	2	1	--
CO3	1	1	1	--	--	--	--	--	1	--	--	--	2	1	--
CO4	3	2	2	--	1	--	--	--	1	--	--	--	2	1	--
CO5	2	2	1	--		--	--	--	2	--	--	--	2	1	--
CO6	2	2	2	1	1	--	--	--	1	--	--	--	2	1	--

References:

Text Books	
1	Mechanical Measurements & Control by D. S. Kumar, Metropolitan Book Co. (P) Ltd.
2	Mechanical Measurements and Instrumentation (Including Metrology and Control Systems) by R. K. Rajput, Published by S. K. Kataria & Sons, 2013
3	Mechanical Measurements Shawney/McGraw Hill Publishers
Reference Books	
1	Control System Engineering: R Anandnatarajan, P. Ramesh Babu, SciTech Publication.
2	Control Systems: A. Anand Kumar, Prentice Hall Publication.
3	Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers
4	Instrumentation and Mechanical Measurements / A.K. Tayal / Galgotia Publications.

Web Links/ Video Lectures

https://nptel.ac.in/courses/101/104/102105090/
https://nptel.ac.in/courses/101/104/107106081/
https://nptel.ac.in/courses/101/104/108106150/
https://nptel.ac.in/courses/101/104/117106108/

ME504-MODELLING AND SIMULATION OF MANUFACTRING SYSTEMS

Lectures	**:**	2Hrs/Week	**Evaluation Scheme**		
Credit	**:**	2	**ISE**	**:**	40 Marks
Tutorials	**:**	--	**ESE**	**:**	60 Marks

Course Objectives : The objective of the course is to

1. Acquaint students with basics of simulation modeling
2. Increase understanding of random numbers and random variates in simulation and being able to generate it using different techniques
3. Enable development of simulation models using heuristic methods
4. Enable analysis of simulation model using input analyzer and output analyzer
5. Comprehend the usefulness of simulation as a tool for problem solving to solve real world problems

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Define the basics of simulation modeling and understanding how to replicate the practical situations in organizations	Knowledge Understand
CO2	Generate random numbers and random variates using different techniques	Understand
CO3	Develop simulation model using heuristic methods.	Apply
CO4	Apply statistical distribution to replicate the real-world situations	Apply
CO5	Analysis of Simulation models using input analyzer, and output analyzer	Analyze
CO6	Explain Verification and Validation of simulation model	Analyze

Description:

Process Modelling & Simulation course is offered as an open elective course. The course deals with all important aspects of discrete event system simulation with particular emphasis on application in manufacturing, services and computing.

Prerequisites:	1:	Basic knowledge of numerical mathematics
	2:	Basic knowledge of probability
	3:	Basic knowledge of statistics

Section – I		
Unit 1	**Introduction to Simulation**	
	Introduction to Simulation: Simulation, Advantages, Disadvantages, Areas of application, System environment, components of a system, Model of a system, types of models, steps in a simulation study. Simulation Examples: Simulation of Queuing systems, Simulation of Inventory System, Other simulation examples.	**6Hrs**
Unit 2	**General Principles and Random Numbers**	
	General Principles: Concepts in discrete - event simulation, event scheduling/ Time advance algorithm, simulation using event scheduling. Random Numbers: Properties, Generations methods, Tests for Random number- Frequency test, Runs test, Autocorrelation test.	**5Hrs**
Unit 3	**Random Variate Generation and Optimization**	
	Random Variate Generation: Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and log normal Distributions, convolution methods- Erlang distribution, Acceptance Rejection Technique Optimisation Via Simulation: Meaning, difficulty, Robust Heuristics, Random Search.	**5Hrs**
Section – II		
Unit 4	**Analysis of Input Data and Verification & Validation of Model**	
	Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis. Verification and Validation of Model – Model Building, Verification, Calibration and Validation of Models.	**5Hrs**
Unit 5	**Analysis of Output Data**	
	Output Analysis – Types of Simulations with Respect to Output Analysis, Stochastic Nature of output data, Measures of Performance and their estimation, Output analysis of terminating simulation, Output analysis of steady state simulations.	**5Hrs**
Unit 6	**Problem Solving and Case Studies**	
	Introduction to Monte Carlo Simulation, Inventory Control Simulation using Monte Carlo Techniques, Problem Solving on Monte Carlo Simulation. Different case studies on usefulness of simulation modelling for real manufacturing system	**4Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	--	--	--	--	--	--	---	--	--	--	--	--	--	--
CO2	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--
CO3	2	1	1	--	--	--	--	--	--	--	--	--	--	--	--
CO4	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO5	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO6	3	1	--	--	--	--	--	--	--	--	--	--	--	--	--

References:

Text Books	
1	Jerry Banks, John S Carson, Berry L Nelson, David M Nicol, Discrete Event System Simulation, Pearson Education, Asia, 4th Edition, 2007, ISBN: 81-203-2832-9
2	Geoffrey Gordon, System Simulation, Prentice Hall Publication, 2nd Edition
3	Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering Series, 4th Edition
Reference Books	
1	Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004, ISBN: 0-87692-028-8
2	Frank L Severance, System Modelling and Simulation, Wiley, 2001

Video Lectures

NPTEL Course.https://archive.nptel.ac.in/courses/112/107/112107220/

ME505 MANUFACTURING ENGINEERING

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	----	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Study of metal cutting technology including the process, measurements.
2. Design and selection of various cutting tools and their industrial specifications
3. Study of Geometry of various cutting tools
4. Introduce the students to design practices of toolings (Jigs and Fixtures)
5. Study of various press working tools
6. Study of various aspects of CNC machine technology and its tooling.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Comprehend various metal cutting theories.	Knowledge Understand
CO2	Identify and select proper cutting process and cutting tool considering work piece materials.	Understand Apply
CO3	Interpret parameters of single and multipoint cutting tools.	Knowledge Understand
CO4	Classify, design and draw Jigs and Fixtures for the manufacturing of given mechanical components.	Apply Create
CO5	Design various dies for press working operations by considering principles and established theory.	Apply Analyze
CO6	Understand various terminologies used in CNC machines and its applications.	Understand Apply

Description:

This subject is an advanced part of the manufacturing processes and machine tools. It deals with the design of tools required for general and special machines.

Prerequisites:	1:	Manufacturing Processes
	2:	Machine tools

Section – I		
Unit 1	**Theory of Metal Cutting**	
	Wedge action, Concept of speed, Feed and depth of cut, orthogonal and oblique cutting. Mechanics of metal cutting-Chip formation, Types of chips, cutting ratio, shear plane and shear angle, velocity relationships, force measurement by tool dynamometers.	**7 Hrs**
Unit 2	**Tool Life**	
	Cutting tool materials and their properties, Advanced cutting tools. Machinability of Metals- Factors affecting, improvement and machinability index. Tool life - Types of wear, relationship with cutting parameters, Taylors equation, improvement measures. Surface finish- Factors affecting, effect of cutting parameters, improvements. Heat generation in machining, its effect on cutting force, tool life and surface finish, types and selection criteria of cutting fluids.	**7 Hrs**
Unit 3	**Tool geometry**	
	Tool geometry Parts, angles and types of single point cutting tools, tool geometry of single point cutting tool, tool geometry of multipoint cutting tools.-drills, milling cutters, reamers.	**6 Hrs**
Section – II		
Unit 4	**Drilling Jigs and Milling Fixtures**	
	Applications, basic elements, principles and types of locating, clamping and indexing elements, auxiliary elements like tenon, setting block etc. Types of Drilling jigs and Milling fixtures-Design consideration of Jigs and fixtures with respect to different operations.	**8 Hrs**
Unit 5	**Press Tools**	
	Dies, punches, types of presses, clearances, types of dies, strip layout, calculation of press capacity, center of pressure, Design consideration for die elements (Theoretical treatment only). Problems on Blanking and Piercing operations	**7 Hrs**
Unit 6	**CNC Technology and Tooling**	
	CNC Technology and CNC tooling: Introduction, Construction and working of CNC, DNC and machining center. CNC axes and drives. Automatic Tool Changer (ATC) and Automatic pallet changer (APC) New trends in Tool Materials, Turning tool geometry, Tool inserts (coated and uncoated), Modular tooling system for Turning, Milling tooling systems, Tools presetting, Work holding	**5 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	--	--	--	--	--	---	--	--	--	--	--	--	3
CO2	3	2	--	--	--	--	--	--	--	--	--	--	--	--	3
CO3	2	--	--	--	--	--	--	--	--	--	--	--	--	--	3
CO4	3	2	2	--	2	--	--	--	--	--	--	--	2	--	3
CO5	3	2	1	--	2	--	--	--	--	--	--	--	--	--	3
CO6	2	1	--	--	2	--	--	--	--	--	--	--	--	--	3

References:

Text Books	
1	"Elements of Workshop Technology Vol. II", S. K Hajra Choudhury , Media Promoters and Publishers, Mumbai.
2	"Text Book of Production Engineering", P.C. Sharma, S. Chand Publication, 11th Edition.
3	"Machine Tool Engineering" G.R. Nagarpal, Khanna Publication.
4	"Principles of Modern Manufacturing", Groover, Wiley Publication., 5th Edition.
Reference Books	
1	"Production Technology", HMT –Tata McGraw-Hill Publishing Ltd,. ISBN, 0070964432, 9780070964433., (2001).
2	"Metal Cutting Theory and Tool design" Mr. Arshinnov, MIR Publication.
3	"Fundamentals of Tool Design" ASTME,Prentice-Hall of India Private Ltd., New Delhi Publication, (1976).
4	"Tool Design", Donaldson,THM Publication, 3rd Edition.
5	"Machine Tool Engineering", G.R. Nagarpal, Khanna Publication.

Web Links/ Video Lectures

Lectures
1. **https://nptel.ac.in/courses/112105233**
2. **https://www.youtube.com/watch?v=7yzvno4AvKw**
3. **https://www.youtube.com/watch?v=vOo2MCYPsm4**
4. **https://www.youtube.com/watch?v=0z7dYQHhQUI**
5. **https://www.digimat.in/nptel/courses/video/112105211/L01.html**

ME505-COMPUTER INTEGRATED MANUFACTURING

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	--	**ESE**	**:**	60 Marks

Course Objectives : The objective of the course is to

1. To understand the concepts of computer integrated manufacturing system and elements of CIM.
2. To study product design, CAD/CAM and concurrent engineering concept
3. To learn coding methods, Computer aided process planning and computer aided production planning
4. To understand Flexible Manufacturing system and Distributed Numerical Control.
5. To know various robots and automated guided vehicles in industries.
6. To provide knowledge about Data communication.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Summarize the definition of CIM, implementation of CIM and Economic and social justification of CIM.	Knowledge Understand
CO2	Understand the scope of CAD / CAM and CIM	Understand
CO3	Apply the group technology concept and computer aided process planning techniques in manufacturing.	Apply
CO4	Identify the functions of FMS and Flexible assembly system	Apply
CO5	Describe various robots and automated guided vehicle used in industries	Apply Understand
CO6	Illustrate data and data base management system, network concept and role of communication in CIM	Evaluate

Description:

Computer-integrated manufacturing (CIM) refers to the use of computer-controlled machineries and automation systems in manufacturing products. CIM combines various technologies like computer-aided design (CAD) and computer-aided manufacturing (CAM) to provide an error-free manufacturing process that reduces manual labor and automates repetitive tasks. The CIM approach increases the speed of the manufacturing process and uses real-time sensors and closed-loop control processes to automate the manufacturing process. It is widely used in the automotive, aviation, space and ship-building industries.

Prerequisites:	1:	Basic elements of an automated system
	2:	Material handling and identification technologies
	3:	Manufacturing systems

Section – I		
Unit 1	**Basic Concept of CIMS**	
	Scope, islands of automation, architecture of CIM, elements of CIM, benefits, limitations, Types of production ,obstacles in implementation Planning for CIMS, need for planning, Phases of CIM implementation, Economic and social justification of CIM.	**6Hrs**
Unit 2	**Role of Computers in design and manufacturing**	
	Product Design and CAD, application of computers in design, CAM – manufacturing planning and control, scope of CAD / CAM and CIM, Concurrent engineering, Design for manufacturing and assembly, Case studies on Concurrent engineering, Design for manufacturing and assembly	**7 Hrs**
Unit 3	**Group Technology, Computer Aided Process Planning and Control & Computer Aided Production planning and Control**	
	Concept, design and manufacturing attributes, part families, composite part, methods of grouping, PFA, classification and coding system- OPITZ, Relevance of GT in CIM, GT and CAD, benefits and limitations of GT, Computer Aided Process Planning and Control: retrieval and generative type CAPP, role of CAPP in CIM, Master Production Schedule – Material Requirement planning – Capacity Planning-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II)	**7 Hrs**
Section – II		
Unit 4	**Flexible Manufacturing Systems, Transfer lines, Assembly Lines in CIMS**	
	Concept of flexible & rigid manufacturing, manufacturing cell and FMS structure, types, components of FMS, Distributed Numerical Control (DNC), Building Blocks of FMS, Flexible Assembly System, Transfer Lines, concept, applications, benefits, Automates assembly lines, Design for assembly.	**7 Hrs**
Unit 5	**Production Support Machines and Systems in CIM: Robots, types, joint configurations**	
	Industrial robots for load/unload, automated material handling, automatic guided vehicles, Types, Vehicle guidance, Management and safety, automated storage and retrieval system**.**	**6 Hrs**
Unit 6	**Data Acquisition, Database Management Systems** & **Communication in CIMS**	
	Data acquisition system, type of data, automatic data identification methods, bar code technology, machine vision.(b) Data and database management system, types of DBMS models- hierarchical, network and relational models and their applications, Role of communication in CIMS, requirements of shop floor communication, types and components of communication systems in CIM, Networking concepts, network topology, ISO-OSI reference model for protocols, MAP/TOP, TCP/IP	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	--	2	--	2	2	--	--	--	--	1	--	--	--	--
CO2	3	2	2	2	2	--	--	--	--	--	--	--	--	--	--
CO3	2	2	2	--	3	--	--	--	--	--	--	--	--	--	--
CO4	2	2	2	2	2	--	--	--	--	--	1	--	--	--	--
CO5	2	2	2	2	3	3	--	--	--	--	1	--	--	--	--
CO6	2	--	2	--	2	2	--	--	--	--	2	--	2	---	--

References:

Text Books	
1	Automation, Production systems and Computer Integrated Manufacturing, 3/e - M. P. Groover (PHI or Pearson Education)
2	Radhakrishnan P, SubramanyanS.andRaju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.
Reference Books	
1	Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India.
2	Rao. P, N Tewari & T. K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.
3	Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.

Web Links/ Video Lectures

1.https://nptel.ac.in/courses/112104289

ME501P- THEORY OF MACHINE-II LAB

Practicals : 2 Hrs/Week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : 25 Marks

Course Objectives: The objective of the course is to

1. Learn about various elements used in mechanism such as gears, gyroscope etc.
2. Identify and make different types of gear trains required in machines
3. Recommend particular mechanism as per the specified applications

Course Outcomes:		**Blooms Taxonomy**
Cos	**At the end of successful completion of the course, the student will be able to**	
CO1	Understand classification, construction, working of different types of gears and gear trains used in machines.	Knowledge Understand
CO2	Identify the effect of gyroscopic couple in machines	Analyze
CO3	Know the Problems of balancing in rotary machines and provide the appropriate solution for the same.	Understand Evaluate
CO4	Estimate and determine forces in simple mechanism.	Analyze Evaluate

Description:

The Theory of machine laboratory consists of a number of models of gears, gears trains, and various mechanisms. Students are able to enhance their basic and fundamental knowledge of Theory of machine by effective using of these models.

Prerequisites:	1:	Applied mechanics
	2:	Basic Engineering Mathematics

Practicals: (Any 8 Experiments)

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Generation of involute profile using rack cutter method.	2	Create
2	Experiment on Gyroscope.	2	Understand
3	Experiment on Torque Measurement in epicyclical Gear Train	2	Apply
4	Determination of M.I. using bifilar suspension system.	2	Analyze Evaluate
5	Determination of M.I. using Trifilar Suspension system.	2	Analyze Evaluate
6	Experiment on Balancing of rotary masses (Static and Dynamic).	2	Analyze Evaluate
7	Determination of M.I. of connecting rod by Compound pendulum method.	2	Analyze Evaluate
8	Assignment on Flywheel.	2	Understand
9	Problems on balancing of reciprocating masses. (Minimum 3)	2	Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	--	1	2	1	--	--	--	--	1	2	--	--	--
CO2	3	1	--	1	2	2	--	--	--	--	2	2	--	--	--
CO3	1	1	2	1	2	1	--	--	--	--	1	2	--	--	--
CO4	3	1	2	1	2	1	--	--	--	--	1	2	--	--	--

References:

Text Books	
1	Theory of Machines, Rattan S.S. ,Tata McGraw Hill, Publications.
2	Mechanism and Machine Theory, Rao, Dukkipati, New Age International.
3	Theory of Machines , J. K. Gupta & R. S. Khurmi , S. Chand Publications
Reference Books	
1	Theory Of Machines And Mechanisms, John J. Uicker, Gordon R. Pennock & Joseph E. Shigley, Oxford University Press, 4th Edition.
2	Theory of Machines, Thomas Beven, Pearson Publisher, 3rd Edition.
3	Theory of Mechanisms & Machines, Jagdish Lal, Publisher, Metropolitan Book Company.

ME502P - HEAT & MASS TRANSFER LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : 25 Marks

Course Objectives: The objective of the course is to
1. Study the experiments to determine the thermal conductivity of metal and insulating materials 2. Experimentally calculate heat transfer performance parameters for natural convection, forced convection and radiation modes. 3. Calculate the emissivity of surface which is required for radiation heat transfer analysis

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Apply heat transfer principles to determine the thermal conductivity of metal and insulating materials	Apply
CO2	Calculate heat transfer coefficient for natural and forced convection by performing experiments.	Apply
CO3	Estimate emissivity of given surface and Stefan Boltzmann constant in radiation mode.	Apply Analyze
CO4	Demonstrate and analysis the performance heat exchanger and heat pipe	Analyze

Description:

In heat and mass transfer analysis, thermal conductivity, convective heat transfer coefficients and emissivity are the important properties. In this lab, students will get experimental approach to estimate these values for different materials and thermal systems. This subject provides knowledge about how to determine heat transfer through composite structure system, heat exchanger and extended surfaces. It is useful for students to solve real time problems of industries.

Prerequisites:	1:	Fluid Mechanics
	2:	Basic Thermodynamics
	3:	Engineering Mathematics

Practicals

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Determination of thermal conductivity of insulating powder	2	Understand Apply
2	Determination of thermal conductivity of a Metal rod	2	Apply
3	Determination of thermal resistance and temperature distribution in a Composite wall	2	Apply
4	Determination of thermal conductivity of insulating material in Lagged pipe	2	Apply
5	Determination of local and average heat transfer coefficient in Natural convection heat transfer from a vertical cylinder	2	Apply
6	Determination of Heat Transfer Coefficient under forced convection to air through pipe.	2	Apply
7	Determination of emissivity of a Nonblack surface.	2	Apply
8	Determination of Stefan Boltzmann Constant.	2	Apply
9	Determination of overall heat transfer coefficient and effectiveness in a Parallel Flow and Counter Flow Heat Exchanger	2	Apply Analyze
10	Study and Demonstration of Heat Pipe	2	Understand Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	--	2	--	--	--	---	--	--	--	--	--	3	--
CO2	3	1	--	2	--	--	--	---	--	--	--	--	--	3	--
CO3	3	1	--	2	--	--	--	---	--	--	--	--	--	3	--
CO4	3	1	--	2	--	--	--	---	--	--	--	--	--	3	--

References:

Text Books	
1	"Heat and Mass Transfer", R. K. Rajput, S. Chand and Company Ltd., New Delhi., 5th Edition
2	"Heat Transfer", J.P. Holman, Tata McGraw Hill Book Company, New York, 2nd Edition
3	"Fundamentals of Heat and Mass Transfer", R.C. Sachdeva, Willey Eastern Ltd., New York, 2nd Edition
4	"Heat and Mass transfer", M. M. Rathod, Laxmi Publications
Reference Books	
1	"Heat Transfer – A Practical approach", Yunus. A .Cengel, Tata McGraw Hill
2	"Heat Transfer" Chapman A. J., Tata McGraw Hill Book Company, NewYork
3	"Fundamentals of Heat and Mass Transfer", Frank P. Incropera, David P. Dewitt,Wisley India. 5th Edition
4	"A Text Book on Heat Transfer", Dr. S. P. Sukhatme, Orient Longman Publication Hyderabad
5	"Heat and Mass Transfer", S. C. Arora and S. Domkundwar, Dhanpat Rai and Sons, Delhi

ME503T – DESIGN OF MACHINE ELEMENTS -I LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : NA

Course Objectives: The objective of the course is to
1. Study basic principles of machine design. 2. Understand the methods involved in evaluating the dimensions of a component to satisfy Functional and strength requirements. 3. Learn use of catalogues and design data book to extract required design information

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify and apply basic principles of machine design.	Knowledge Understand
CO2	Design machine elements on the basis of strength concept.	Understand Apply
CO3	Formulate and solve the problems of various machine elements used in industries.	Apply Analyze
CO4	Prepare assembly and detail drawings for different machine elements.	Analyze

Description:

The main task of mechanical engineer is to design the mechanical elements as per the requirement to accomplish the objective of task. It is done by the study of this course. It covers principles, theory, and mathematical expressions regarding the design process. By applying the basic principles of machine design students should be able to design the Machine Elements like Knuckle Joint, Turn Buckle, lever, Shaft, Couplings, Welded & Bolted joints, Springs and Belts.

Prerequisites:	1	Mechanics
	2	Analysis of Mechanical Elements
	3	Theory of Machines –I

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Assignments on selection of materials for various components showing their IS codes, composition and properties	2	Knowledge Understand
2	Design and Drawing of Knuckle joint.	2	Understand Analyze
3	Design and Drawing of flexible bushed pin type flanged coupling.	2	Understand Analyze
4	Assignments on Problems on Bolted Joint.	2	Apply
5	Assignments on Problems on Design of helical compression spring subjected to static load.	2	Apply Analysis
6	Assignments on Problems on Selection of Belts as per the manufacturer's catalogue.	2	Evaluate

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	2	2	--	--	--	---	1	--	--	--	2	--	2
CO2	2	2	2	2	--	--	--	--	1	--	--	--	2	--	2
CO3	2	2	3	2	--	--	--	--	1	--	--	--	2	--	2
CO4	2	2	2	2	--	--	--	--	1	--	--	--	2	--	2

References:

	Text Books
1	"Design of Machine Elements", V.B.Bhandari., Tata McGraw Hill Publication, 3rd Edition.
2.	"A Text Book of Machine Design", R.S. Khurmi and J.K.Gupta.
3.	"Machine Design", Pandya Shah, Charotar Publication.
4.	"Machine Design", U.C.Jindal, Pearson Education.
	Reference Books
1	"Design of Machine Element", J.F. Shigley, Tata McGraw Hill Publication.
2	"Design of Machine Element" M.F.Spotts, Pearson Education Publication, 6th Edition.
3	"Machine Component Design",Robert C. Juvniall, Willey Ltd, 5th Edition.

ME504T (OEC-I) INDUSTRIAL INSTRUMENTATION AND CONTROL

Practicals : 2 hrs/ week
Credits : -

Examination Scheme
ISA : 25 Marks
POE : NA

Course Objectives: The objective of the course is to

1. To impart knowledge of architecture of the measurement system
2. To deliver working principle of mechanical measurement system
3. To study concept of mathematical modeling of the control system
4. To acquaint with control system under different time domain

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Classify various types measuring system and their static characteristics and types of errors occurring in the system.	Knowledge Understand
CO2	Classify and select proper measuring instrument for linear and angular displacement, acceleration	Understand Apply
CO3	Classify and select proper measuring instrument for pressure and temperature measurement	Understand Apply
CO4	Design mathematical model of system/process for standard input responses	Design
CO5	Analyze error and differentiate various types of control systems and time domain specifications	Apply Evaluate

Description:

Instrumentation and control is at the core of all industrial and manufacturing activities. Within a production facility, every process must be carefully monitored and controlled to proceed in a predetermined fashion like optimized and safe. When working with heavy and dangerous equipment, getting accurate measurements can be a very difficult process. This is why instrumentation is so important. Because of the number of processes involved in modern machines, accurate instrumentation and control is needed to ensure that everything is operating properly

Prerequisites:	1:	Fluid mechanics, Applied physics,
	2:	Electrical technology basic terms
	3:	Partial Differentiation, Laplace transformation Differentiation and integration formulae

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Study of measuring instruments and understanding of static characteristic and errors	2	Understand Knowledge
2	Study of displacement, strain, angular velocity and acceleration measurement.	2	Understand Knowledge
3	Study pressure, flow and temperature measurement	2	Understand Knowledge
4	Study different control systems and prepare mathematical modeling of control system	2	Analyze Apply
5	Study of response of systems for various input signals and find time domain specifications for second order system	2	Analyze Apply
6	Study of stability of control system based on Root locus	2	Analysis Evaluate

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	--	--	--	--	--	---	1	--	--	--	2	1	--
CO2	1	1	1	--	--	--	--	--	1	--	--	--	2	1	--
CO3	1	1	1	--	--	--	--	--	1	--	--	--	2	1	--
CO4	3	2	2	--	1	--	--	--	1	--	--	--	2	1	--
CO5	2	2	1	--		--	--	--	2	--	--	--	2	1	--

References:

Text Books	
1	Mechanical Measurements & Control by D. S. Kumar, Metropolitan Book Co. (P) Ltd.
2	Mechanical Measurements and Instrumentation (Including Metrology and Control Systems) by R. K. Rajput, Published by S.K. Kataria& Sons, 2013
3	Mechanical Measurements Shawney/McGraw Hill Publishers
Reference Books	
1	Control System Engineering: R Anandnatarajan, P. Ramesh Babu, SciTech Publication.
2	Control Systems: A. Anand Kumar, Prentice Hall Publication.
3	Mechanical and Industrial Measurements by R.K. Jain,Khanna Publishers
4	Instrumentation and Mechanical Measurements by A.K. Tayal,Galgotia Publications.

Web Links/ Video Lectures

https://nptel.ac.in/courses/101/104/102105090/
https://nptel.ac.in/courses/101/104/107106081/
https://nptel.ac.in/courses/101/104/108106150/

ME504T-MODELLING AND SIMULATION OF MANUFACTRING SYSTEMS

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : NA

Course Objectives: The objective of the course is to

1. Enable development of simulation models using heuristic methods.
2. Enable analysis of simulation model using input analyzer and output analyzer
3. Comprehend the results of the simulation model and draw conclusions

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.	Apply
CO2	Develop simulation models and execute it to generate meaningful results.	Apply
CO3	Interpret the model and results to resolve critical issues in a real-world environment.	Apply

Description:

The Process Modelling & Simulation tutorial consists of several exercises where students will be working on developing simulation model to replicate manufacturing system and service operation. Students understand the underlying concept while working on simulation package for replicating the manufacturing systems and learn to comprehend the results from simulation output.

Suggested Simulation Packages: Promodel, Arena, Quest, Witness, Extend, Simio

Prerequisites:	1:	Basic knowledge of numerical mathematics
	2:	Basic knowledge of probability
	3:	Basic knowledge of statistics

Tutorials:

Sr. No.	Tutorial Topic	Hrs.	Bloom's Taxonomy
1	Features of simulation package	2	Understand Apply
2	Simulation of Manufacturing System I	2	Understand Apply
3	Simulation of Manufacturing System II	2	Understand Apply
4	Simulation of Service Operation I	2	Understand Apply
5	Simulation of Service Operation II	2	Understand Apply
6	Simulation of JIT Kanban Multi Product Assembly Line System	2	Understand Apply
7	Simulating real world system	2	Understand, Analyze, Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	--	--	--	--	--	---	--	--	--	--	--	--	--
CO2	2	1	3	--	--	--	--	--	--	--	--	--	--	--	--
CO3	2	1	3	2	--	--	--	--	--	--	--	--	--	--	--

References:

Text Books	
1	Jerry Banks, John S Carson, Berry L Nelson, David M Nicol, Discrete Event System Simulation, Pearson Education, Asia
2.	Geoffrey Gordon, System Simulation, Prentice Hall Publication, 2nd Edition
3.	Averill M Law, W David Kelton, Simulation Modelling & Analysis, McGraw Hill International Editions – Industrial Engineering Series, 4th Edition
Reference Books	
1	Narsingh Deo, Systems Simulation with Digital Computer, PHI Publication (EEE), 3rd Edition, 2004
2	Frank L Severance, System Modelling and Simulation, Wiley, 2001

VideoPracticals
NPTEL Tutorial.https://archive.nptel.ac.in/courses/112/107/112107220/

ME506P – ARDUINO MODEL MAKING LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 50 Marks
POE : 25 Marks

Course Objectives: The objective of the course is -

1. To illustrate and demonstrate programming for basic Arduino models.
2. To demonstrate and facilitate students to learn the fundamentals of digital systems and op-amps which are necessary for Arduino based simple models.
3. To illustrate and facilitate to build the prototype circuits and connect them to the Arduino for building useful models.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to-	Blooms Taxonomy
CO1	Understand the Arduino programming language and IDE used in industrial applications.	Knowledge, Understand
CO2	Demonstrate the interfacing various sensors with Arduino.	Knowledge Apply
CO3	Install Arduino IDE (Integrated Development Environment - or Arduino Software), run the Arduino executable file, Using IDE to prepare Arduino sketch.	Apply, Synthesis
CO4	Use Arduino to build specific application/system.	Create

Description:

Arduino based model making laboratory is both a hardware platform and a programming language. By learning how to build circuits and code, students can add a new level of interactivity to their projects. The Arduino programming language is based on a combination of C and C++. Learn the Arduino platform and programming language to create robots, electronic toys, home automation tools, and much more. The laboratory is an excellent learning drive for the students to understand the building block of Integrated circuits using breadboards, transistors, resistors, capacitors, LED, motor controls, etc.

Prerequisites:	1:	C and C++
	2:	Basic Electronics Engineering

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1.	Writing a program to blink the onboard LED	2	Understand
2.	Arduino interfacing with Tricolor LED and Push button	2	Knowledge
3.	Sensing analog voltage using onboard ADC and printing it on serial monitor	2	Understand
4.	Using Arduino to generate Pulse width modulation output	2	Evaluate
5.	Arduino-based servo motor control	2	Analyze
6.	Interfacing of ultrasonic distance sensor(HC-SR04) with Arduino	2	Create
7.	Ethernet and Wi-Fi Connectivity with Arduino	2	Create
8.	Arduino interfacing with Tricolor LCD	2	Knowledge
9.	Use of Arduino for small model	2	Create

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	--	--	--	--	--	---	--	--	--	--	--	1	--
CO2	3	1	--	--	--	--	--	---	--	--	--	--	--	1	--
CO3	3	1	--	--	--	--	--	---	--	--	--	--	--	1	--
CO4	3	1	--	--	--	--	--	---	--	--	--	--	--	1	--

References:

Text Books:	
1	"Arduino Cookbook", Michael Margolis, O'Reilly Publications, 2020.
Reference Books:	
1	"Beginning Arduino", Michal Mc Roberts, Second Edition, Apress Publishing, 2013.
2	"Getting started with Arduino", Massimo Banzi, 2nd Edition, O'Reilly, 2011.

ME507 – MANUFACTURING SKILL DEVELOPMENT LAB -III

Practicals : 2 hrs/ week
Credits : **1**

Examination Scheme
ISA : 50 Marks
POE : NA

Course Objectives: The objective of the course is to

1. Study and use of Milling machine, Surface Grinding Machine, Shaping machine operations.
2. Understand the principles CNC and VMC
3. Provide an insight to different machine tools, accessories and attachments
4. Train students into machining operations to enrich their practical skills
5. Know Elements of CNC and VMC to Learn CNC Machining, turning center and milling center

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Demonstration of Milling machine, Shaping Machine, and Grinding Machine.	Knowledge Understand
CO2	Perform turning facing & other operations on the lathe machine	Apply Create
CO3	Prepare the Spur Gear on Milling machine and Carry key way operation on shaping machine	Apply Create
CO4	Demonstration of CNC and VMC with Elements, power drives, spindle drives	Knowledge Understand

Description:

Manufacturing Skill Development lab –III makes use of Milling machine, Surface Grinding Machine, shaping machine operations and also it gives principles of CNC and VMC with an insight of different machine tools, accessories and attachments train students into machining operations to enrich their practical skills. To know Elements of CNC and VMC to Learn CNC Machining, turning center and milling center.

Prerequisites:	1	Workshop Technology
	2	Manufacturing Processes
	3	Tool Engineering

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Introduction to Milling machine, Shaping Machine, and Grinding Machine.	2	Knowledge understand
2	Perform turning facing & other operations on the lathe machine	2	Apply
3	Prepare the indexing mechanism to manufacture Spur Gear on Milling machine	2	Apply
4	Prepare the Spur Gear on Milling machine.	4	Apply
5	Perform key way operation on Shaping Machine	2	Apply
6	Carry out Surface Grinding operation	2	Apply
7	Introduction to CNC& VMC: Numerical control, components of CNC& VMC machine, types of motions, classification of CNC& VMC machines	2	Knowledge understand
8	Elements of CNC & VMC: Basic functions of CNC machining, drives, power drives, spindle drives, Electrical drives.	2	Knowledge understand
9	CNC machining – turning centers: Types of CNC turning and milling centers, Discussions on CNC maintenance.	2	Understand
10	One Simple job on CNC/VMC.	4	Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	--	--	--	2	--	--	---	--	--	--	1	--	--	--
CO2	3	1	--	--	2	--	--	---	--	--	--	--	---	--	2
CO3	2	1	--	1	--	--	--	---	--	--	--	--	---	--	--
CO4	3	-	-	1	--	--	--	---	--	--	--	--	---	--	--

References:

Text Books	
1	"Workshop Technology Vol. II", Raghuvanshi
2.	"Workshop Technology Vol. II", Hajara Choudhary, Media Promoters and Publishers, Mumbai
3	"Manufacturing Process-II by Kestoor Praveen fifth Edition 2013
Reference Books	
1	"Production Technology", P. C. Sharma, S. Chand Publication ,11th Edition.
2	"Production Technology", HMT handbook
3	"Workshop Practice Manual",V. Venkata Reddy, 6th edition

ME508T - MINI-PROJECT PHASE -I

Practicals : 1 hrs/ week
Credits : 1

Examination Scheme
ISA : 50 Marks
POE : NA

Course Objectives: The objective of the course is to

1. To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc. thereby enhancing the skill and competency part of technical education.
2. To inculcate innovative thinking and thereby preparing students for main project.
3. To familiarize the process of solving the problem in a group.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify small real engineering and societal problems through different types of surveys (Literature survey, Industrial survey etc.)	Understand Knowledge
CO2	Solve and Analyze these problems by using software / analytical / computational tools and techniques by applying engineering principles.	Apply Analyze
CO3	Develop model / technical reports with presenting skills to defend their work in front of technically qualified audience.	Evaluate Create
CO4	Develop problem solving capabilities by self-learning in a team as well as an individual, which leads to lifelong learning.	Analyze

Description:

The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, society and academic institutions. Each student of the project group shall involve in carrying out the project work jointly in constant consultation with guide, batch Incharge and prepare the project report as per the norms provided them.

Prerequisites:	1:	Engg. Mathematics, Engg. Physics, Engg. Chemistry
	2:	Basic Knowledge of Mechanical Engg.

Practical's:

Guidelines and Activities for Mini Project throughout year	
First Semester Activities	
Allotment of Batch in charge and Guide	Department will provide you batch in charge for every batch in the time table. Allotted faculty takes care of whole batch throughout semester. Also after formation of group, project guide will be allotted to each group by department for throughout year. He will be entirely guide you, starting from the selection of topic to the completion. Batch in-charge will keep the record of entire batch during practical hours. He will also coordinate the activity along with guide and project coordinator.
Group formation	Group should be formed within the Batch of 4 to 5 students in one group, not more than that
Topic Selection	By doing the discussion along with your concerned guide. Group should decide the topic for Mini Project. ***Project work shall be based on any of following 1. Design and development/fabrication of small setup/model 2. Theoretical/Software analysis of any small mechanical system/subsystem of large system 3. Testing and analysis of small mechanical system 4. Software program for any mechanical system design or analysis 5. Industrial survey of any mechanical systems, data collection and analysis
Literature review	After selection of topic student should collect related information by searching and xeroxing/ downloading the journal paper from various sources. Also xeroxing the reference books pages related to their topic.
Synopsis Writing	This is important activity of this semester. Synopsis is blueprint/plan of your mini project. With the help of your guide you have to write synopsis in department given format.
Progress presentation	In the middle of semester student should give the presentation on synopsis in front of guide and batch incharge.
Expected work in Semester - I	Each project group must complete, minimum these activities at the end of first semester 1) Synopsis writing 2) Literature Review Chapter (6- 8 pages) 3) Theoretical Design on Paper
Final Presentation of Mini Project semester I	At the end of semester, each group will give presentation on project work of this semester in front of guide, batch in-charge and one more faculty from department. This presentation will be assessed for 25 Marks internal term work. You have to submit two hard copies of your synopsis report to the department along with you have to show the project diary** and literature review file***

Second Semester Activities	
Continuation of Work	Same group with same guide continued their previous semister work in next semister it is expected that at least 30 percent work should completed in first semester
Fabrication and Testing of model/Theoretical analysis /Surveying analysis/Testing of software program	Complete core part of your project as above under the instructions of guide
Presentation of your work in the form of project report	Writing the Project report of 20 to 25 pages in standard format given by department.
Progress presentation	In the middle of semester student should give the progress presentation in front of guide and batch in charge.
Final Presentation of Mini Project semester II	At the end of semester, Students have to give Project Report presentation in front of guide, batch in-charge and one more faculty from department. This presentation will be assessed for 25 Marks internal term work. Every project group should have to submit two hard copies of good quality project reports to the department along with submission of the project diary and literature review file.
Sponsored Project/Participated Project in Project/Paper competition	Sponsored project and project which is participated in project competition/Paper presentation, three bonus Marks shall be considered, in the final term work calculations.
**** Project Diary**	It is simple note book in which students should keep the record of meetings, along with guide and their discussion about mini project. Also you have to maintain the record of rough calculations, drawings and observations of your project.

*** **Literature file**	Collect all the information or material related to your topic (Xerox or printout of journal papers, reference books, Hand books, internet materials etc.) in one file.
Project Report Format:	Project report should be of 10 to 15 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. References: References should have the following format a. For books: “Title of Book”, Authors, Publisher, Edition b. For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	3	--	--	--	--	--	2	--	--
CO2	1	3	3	2	3	--	2	2	--	--	--	--	3	1	3
CO3	--	--	--	--	--	2	3	1	1	3	--	--	--	--	--
CO4	--	--	--	--	--	--	2	---	3	--	3	3	--	--	--

Video Lectures / Practicals

https://www.youtube.com/watch?v=-IiEzaKE_I
https://www.youtube.com/watch?v=Hj15c7Jog4k
https://www.youtube.com/watch?v=0oSDa2kf5I8

ME508A- AUDIT COURSE-V

Practicals : ---
Credits : Non - Credit

Examination Scheme
ISA : ---
Audit Point : 2

Course Objectives:
In today's highly competitive world, students have to undergo a lot of mental stress and also have to get involved in so many things in order to acquire knowledge as per global market trends. Hence co-curricular activities play a very significant role. Students become technically competent and capable to work in versatile engineering fields. As a future technocrats, it is the need of the day to give exposure to advance technology by participating in different co-curricular activities that is existing in the curriculum. Students have to submit participation certificate to the department.
Course Particulars :
Seminar/Paper Presentation Competition participation Or Aptitude Course by Department or Institute

APPROVED BY

Member Secretary
Board of Studies

Chairman
Board of Studies

Chairman
Board of Studies
MECHANICAL ENGG. DEPT
Yasaheb Kore Institute of Engg
& Technology (Autonomous)
Warananagar, Dist. Kolhapur

Academic Dean
T.K.I.E.T., Warananagar

Principal
T.K.I.E.T., Warananagar

Chairman
Academic Council
Yatyasaheb Kore Institute of Engg.
& Technology (Autonomous)
Warananagar, Dist. Kolhapur

YASHWANTRAO KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
WARANANAGAR
Dist. Kolhapur

Seal of Institute

Third Year B. Tech. (Mechanical Engineering)

Second Semester Detailed Syllabus

ME601- INDUSTRIAL FLUID POWER

Lectures: 3 hrs / week
Credits: 3

Evaluation Scheme:
ESE : 60 Marks
ISE : 40 Marks

Course Objectives: The objective of this course is to

1) Impart knowledge about the fundamentals of Hydraulic and pneumatic system.
2) Prepare the students to study different pumps and compressors in hydraulic and pneumatic system.
3) Educate the students about hydraulic fluids and characteristics of fluids.
4) Impart knowledge about various control valves and its functions.
5) Enable the students to design components of Hydraulic and pneumatic system.

Course Outcomes:

COs	At the end of successful completion of the course the student will be able to	Blooms Taxonomy
CO1	Demonstrate Hydraulic and pneumatic system	Understand Apply
CO2	Investigate the performance of Hydraulic and pneumatic system	Apply Analyze
CO3	Explain the use of different types of valves and actuators.	Understand
CO4	Apply Hydraulic and pneumatic system fundamentals to industrial applications	Apply
CO5	Demonstrate about the fundamentals of Hydraulic and pneumatic circuits used in industrial applications	Knowledge Apply
CO6	Select different types of motors and pumps for different applications.	Analyze

Description

Industrial Fluid Power is offered as the program elective course. This course contains basic principles and applications in Hydraulics and Pneumatics in Mechanical Engineering. In this course students will learn about fundamentals, properties, principles and applications of different hydraulic components. Students will get knowledge of designing different hydraulic circuits used in industrial applications. This course has six units namely **i)** Introduction to Fluid Power **ii)** Hydraulic System Elements **iii)** Control of Fluid Power Elements **iv)** Elements of Pneumatic System **v)** Hydraulic Circuits and its Application **vi)** Pneumatic Circuits and its Application

Prerequisites:	1:	Engineering Physics
	2:	Basic Mechanical Engineering
	3:	Fluid Mechanics
	4:	Applied Thermodynamics

Section - I		
Unit 1	**Introduction to Fluid Power**	
	Classification, general features, applications in various fields of engineering, various hydraulic and pneumatic ISO/JIC Symbols, transmission of power at static and dynamic states, advantages and disadvantages. Principle of hydraulic system, Types of hydraulic fluids and their properties, selection of fluid, effect of temperature on fluids. Introduction and Application of pneumatics, Physical properties, Principles, basic requirements of pneumatic system, comparison with hydraulic system.	**8 Hrs.**
Unit 2	**Hydraulic System Elements**	
	Classification, types of seals, sealing material, pipes, hoses, compatibility of seal with fluid, sources of contamination and its control, strainer, filter, heat-exchanger, reservoir. Pumps-types, selection of pumps from Gear, vane, piston, screw, ball pump etc. for various applications. Actuators-linear and rotary, hydraulic motors, types of hydraulic cylinders and their mountings. Accumulators, intensifier and their applications.	**6 Hrs.**
Unit 3	**Control of Fluid Power Elements**	
	Requirements of Pressure control, direction control and flow control valves. Principle of pressure control valves directly operated and pilot operated pressure relief valve, pressure reducing valve, sequence valves, counter balance valve. Principles and Types of direction Control valves-2/2, 3/2, 4/2, 4/3, 5/2. Open center, close center, tandem center, manual operated, mechanical operated solenoid, pilot operated direction control valves, check valves. Principles of flow control valves, temperature compensated, pressure compensated, temperature and pressure compensated flow control valve. Hydraulic servo system for linear and rotary motion.	**6 Hrs.**

Section - II		
Unit 4	**Elements of Pneumatic System**	
	Air compressor- Types, selection criteria, capacity control, piping layout, fitting and connectors, Pneumatic controls, 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, Pneumatic actuators, Rotary and reciprocating cylinders–types and their mountings, Air motor – types, Comparison with hydraulic and electric motor. Serving of compressed air – types of filters, regulators, lubricators (FRL unit), mufflers, dryers. Maintenance, troubleshooting and safety of hydraulic and pneumatic system.	**8 Hrs.**
Unit 5	**Hydraulic Circuits and its Application**	
	Speed control circuits – Meter-in, Meter-out, Bleed off, Regenerative, Fast approach and slow traverse. Sequence circuits – Travel dependent and Pressure dependent Synchronizing circuit. Regenerative circuit.	**6 Hrs**.
Unit 6	**Pneumatic Circuits and its Application.**	
	Speed control circuits Impulse operation circuit. Sequence circuits. Time delay circuit.	**6 Hrs**.

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	--	3	--	--	--	1	--	--	--	2	--	--	1	2	--
CO2	3	--	--	--	2	1	--	--	--	1	--	1	1	2	--
CO3	3	--	--	--	1	--	--	--	1	2	--	--	1	2	--
CO4	3	--	--	--	--	1	--	--	--	2	--	--	1	--	--
CO5	2	2	--	--	1	1	--	--	1	2	--	--	1	2	--
CO6	2	2	--	--	1	1	--	--	2	1	--	--	1	1	--

References:

Text Books	
1	“Oil hydraulics Systems”, S. R. Mujumdar, Tata McGraw Hill Publication.
2	“Pneumatic Systems”, S. R. Mujumdar- Tata McGraw Hill Publication.
3	“Industrial Fluid Power”, D. S. Pawaskar, Nishant Prakashan.
4	“Hydraulics and Pneumatics”, Shaikh and Khan, R.K. Publication
5	“Fluid Power with Application”, Esposito, Pearson Education, 7th Edition.
Reference Books	
1	“Industrial Fluid Power”, S.S. Kuber, Nirali Prakashan, 3rd Edition.
2	“Hydraulic and Pneumatic”, H.L.Stewart, Industrial Press.
3	“Industrial Hydraulic”, J. J. Pipenger, Tata McGraw Hill.
4	“Power Hydraulics”, Goodwin 1st Edition.
5	“Introduction to Hydraulic and Pneumatic”, S. Ilango and V Soundararajan, Prentice Hall of India, 2nd Edition.

Video Lectures

Lectures 1. https://archive.nptel.ac.in/courses/112/106/112106300/

ME601-PROCESS PLANNING AND COST ESTIMATION

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	1 Hr/Week	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Understand the basic concept of process planning
2. Understand the different method of cost estimation in different manufacturing shops.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Select the process, equipment and tools for various industrial products.	Understand Knowledge
CO2	Explain the concept of cost estimation.	Knowledge Analyze
CO3	Compute the job order cost for different type of shop floor.	Evaluate
CO4	Calculate the machining time for various machining operations.	Evaluate
CO5	Prepare process planning activity chart.	Create
CO6	Estimate the process costing and accounting of industrial product.	Analyze Create

Description:

Process Planning and Cost Estimations offered as professional elective course. This course has six units namely. Introduction of Process Planning, Process planning activities, Introduction to cost estimation, Machining time estimation, Production costs and Estimation in Forging Shop & Foundry Shop.

Prerequisites:	1:	Metallurgy
	2:	Manufacturing Process and Manufacturing Technology
	3:	Manufacturing Engineering

Section – I		
Unit 1	**Introduction of Process Planning:**	
	Methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection	**07 Hrs**
Unit 2	**Process planning activities:**	
	Process parameter calculation for various production processes, selection of jigs and fixtures, selection of quality assurance methods, documents for process planning, economics of process planning, case studies	**7 Hrs**
Unit 3	**Introduction to cost estimation:**	
	Importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates, estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost.	**6 Hrs**
Section – II		
Unit 4	**Machining time estimation:**	
	Importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planning and Grinding.	**7 Hrs**
Unit 5	**Production costs:**	
	Different production processes for different jobs, estimation of forging cost, estimation of welding cost, estimation of foundry cost, estimation of machining cost.	**6 Hrs**
Unit 6	**Process Costing & Accounting:**	
	Process & Job Costing -Characteristics -Principles -Procedure for Process costing. Wages-types, Incentives-types, Budget-Types, Accounting terminology like -book value-Net Present Value-Work in progress- Gross Domestic Product (GDP)-balance sheet-Tendering- manual tendering and e-tendering.	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	2	--	--	--	--	---	--	--	--	--	--	--	2
CO2	2	2	1	--	3	--	--	--	1	--	--	--	--	--	2
CO3	1	2	3	--	2	--	--	--	1	--	--	--	--	--	2
CO4	1	--	2	2	3	--	--	--	1	--	--	--	--	--	2
CO5	1	--	2	2	3	2	--	--	1	--	--	--	--	--	2
CO6	--	--	1	--	--	2	--	3	1	--	--	--	--	--	2

References:

Text Books	
1	Product Design and Manufacturing, Chitale A.V. and Gupta R.C., 2nd ed., Prentice Hall 2002.
2	“Mechanical estimation and costing”, T. R. Banga and S. C. Sharma, Khanna publishers
3	“Mechanical Estimation”, Malhotra
4	“Industrial organization and Engineering Economics”, T. R. Banga and S. C. Sharma, Khanna publishers
5	Mechanical Estimation, NITTTR Chennai
6	"Mechanical costing and estimation”, Singh and Khan, Khanna Publishers
7	"Process planning & cost estimation" M. Adithan, New age International
Reference Books	
1	Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci. &Tech. 2002.
2	Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, 9th ed., John Wiley 1998.

ME602-METROLOGY AND QUALITY CONTROL

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
			ESE	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Understand the use of standards in measurement, gauges and tolerances.
2. Study the use of various comparators and angle measuring instruments.
3. Study the advanced methods in metrology and measurement of surface roughness.
4. Study the methods used for the measurement of screw threads and gears.
5. Study the concept of quality control and quality assurance and QC tools.
6. Understand the various SQC techniques.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify the use of various measuring instruments and select appropriate instrument for particular feature measurement.	Knowledge Evaluate
CO2	Understand the principles, construction, working and use of comparators and angle measuring instruments.	Understand Apply
CO3	Learn advanced techniques of metrology in various industrial applications. Prepare drawings with general dimensions, tolerances and surface finish.	Understand Apply
CO4	Apply the methods of measurement of screw threads and gears.	Understand Apply
CO5	Distinguish and understand the quality assurance and quality control and different QC tools.	Understand Evaluate
CO6	Interpret various control charts and their applications in process control.	Analysis Evaluate

Description:

The Metrology and Quality Control subject consists of a number of measuring instruments, gauges and their use to check the dimensional features and physical dimensions of various components. Students are able to enhance their basic and fundamental knowledge of machine drawing to study the dimensional features and physical dimensions of the components and by selecting the appropriate measuring instrument they should able to check these dimensional features and physical dimensions of the various components used in the industry.

Prerequisites:	1:	Machine Drawing

Section – I		
Unit 1	**Linear measurement and Limits fits and tolerances.**	
	Need of measurement, International standards of length, line and end measurement, types and sources of errors in measurement, slip gauges, IS specifications of limits, Maximum metal limit and least metal limit, Unilateral and bilateral tolerances, Types of Fits, Gauges and their classification, Taylor's principle of gauge design, Numerical treatment on design of gauges.	**8 Hrs**
Unit 2	**Comparators and Angle Measurement**	
	Classification of comparators and their uses, advantages and disadvantages of various types of comparators. Mechanical comparator (Dial indicator, Sigma and Johansson Mikrokator. Pneumatic comparator (Solex and Differential), Use of Bevel protractor, sine bar, sine center, clinometers, angle dekkor and auto collimator for angle measurement.	**6 Hrs**
Unit 3	**Advancements in Metrology, and surface roughness**	
	Introduction & application of Coordinate Measuring Machine, introduction and use of machine vision system. Principle of interferometry and its application for checking flatness. Surface roughness terminology, Direction of lay, textures, symbols, Numerical assessment of surface roughness, Instruments used in surface roughness assessment. (Tomlinson and Talysurf surface testers)	**6 Hrs**
Section – II		
Unit 4	**Metrology of Screw Threads and Gears**	
	Different errors in screw threads, Measurement of forms of thread with profile projector, Pitch measurement, Measurement of thread diameters with standard wire, screw thread micrometer. Errors in gears, Measurement of Spur Gears, Run out checking, Pitch measurement, Profile checking, Backlash checking, Tooth thickness measurement.	**7 Hrs**
	Quality Control	
	Concept of Quality, 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, Seven QC tools.	**6 Hrs**
Unit 6	**Statistical Quality Control and Acceptance Sampling**	
	Importance of statistical method in quality control, ND curve, Different types of control charts (Numerical treatment on X Bar, R, P and C charts), their constructions and applications, process capability. Basic concept of sampling inspection, Single and double sampling plans, Operating characteristic curves.	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	1	--	2	--	--	--	--	--	--	--	--	1	--	1
CO2	1	2	--	3	--	--	--	--	--	--	--	--	--	--	1
CO3	1	--	2	--	3	--	--	--	--	--	--	--	--	--	1
CO4	1	2	--	2	3	--	--	--	--	--	--	--	--	--	1
CO5	1	2	--	--	1	--	--	--	--	--	--	--	--	--	1
CO6	--	1	2	1	1	--	--	--	--	--	--	--	--	--	1

References:

Text Books	
1	"Engineering Metrology", I.C. Gupta, Dhanpat Rai Publications.
2.	"Engineering Metrology", R. K. Jain, Khanna Publisher.
3.	"Engineering Metrology", M. Mahajan, Dhanpat Rai and Sons.
4.	"Engineering Metrology and Measurements", N. V. Raghvendra and L. Krishnamurthy, Oxford University Press.
Reference Books	
1	"Practical Engineering Metrology", Sharp K.W.B. Pitman, London.
2	"Metrology and Measurements", A. K. Bewoor, Tata McGraw Hill Publication
3	"Metrology", Taher ELBS.
4	"Statistical Quality Control", A.L. Grant, Tata McGraw Hill International, New York. 6th Edition.
5	I.S. 919/1963., IS Fits for Basic Hole System, Part 1
6	I.S. 2709/1964., IS Fits for Basic Hole System, Part 2
7	"Engineering Metrology", Hume K.G., MC Donald, Technical and Scientific, London ,2nd Edition.

Web Links/ Video Lectures

1. https://nptel.ac.in/courses/112106179
2. https://nptel.ac.in/courses/112107259

ME603-DESIGN OF MACHINE ELEMENTS-II

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	1 Hr/Week	**ESE**	**:**	60 Marks

Course Objectives : The objective of the course is able to

1. Design machine elements subjected to fluctuating loading.
2. Understand the standard nomenclature, forces, failures, application, design procedure of Spur, helical ,bevel and worm gears (As per AGMA) and to determine standard geometry under given loading condition by using design data hand book and AGMA procedure.
3. Understand the different types of bearings, application, failures, selection procedure of Ball Bearings (As per Manufacturer Catalog) and Sliding contact bearing and to determine standard design procedure of bearing under different loading condition by using design data hand book.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Evaluate the stresses in machine components due to various types of fluctuating loads and failure of components according to theories of failures.	Knowledge Understand
CO2	Develop capability to analyze rolling contact bearing and its selection from manufacturer's catalogue	Analyze Apply
CO3	Achieve an expertise in design of sliding contact bearing in industrial applications.	Evaluate
CO4	Apply principles of spur gear design during industrial gear boxes.	Understand Apply
CO5	Design of Helical and Bevel Gears.	Analyze Apply
CO6	Design worm gear for various industrial applications.	Analyze

Description:

Design of Machine Elements –II course is offered as professional course. This course has six units namely, Design for Fluctuating Loads, Design of Rolling Contact Bearings, Design of Sliding Contact Bearings, Design of Spur Gear, Design of Helical and Bevel Gears and Design of Worm Gears.

Prerequisites:	1:	Analysis of Mechanical Elements
	2:	Material Science and Metallurgy
	3:	Applied Mechanics

Section – I		
Unit 1	**Design for Fluctuating Loads**	
	Stress concentration - causes and remedies, Fluctuating stresses, S-N. diagram under fatigue load, Endurance limit, Notch sensitivity, Endurance strength modifying factors, Design for finite and infinite life under reversed stresses, Cumulative damage in fatigue failure, Goodman diagram, Modified Goodman diagram, Fatigue design for components under combined stress.	**07 Hrs**
Unit 2	**Design of Rolling Contact Bearings**	
	Rolling Contact Bearing: Types, Static and dynamic load capacities, Stribeck's equation (No Derivation), Equivalent bearing load, Load-life relationship, Bearing life, Load factor, Selection of bearing from manufactures catalogue, Ball and Roller bearing, Design for variable load and speed, Bearings with probability of survival other than 90 %. Lubrication and mountings, Dismounting and preloading of bearings, Oil seal and packing.	**7 Hrs**
Unit 3	**Design of Sliding Contact Bearings**	
	Introduction to Tribological consideration in design Friction, Wear, Lubrication., Sliding Contact Bearing: Bearing material and their properties: Sintered bearing materials, bearing types and their construction details., Hydro-Dynamic Lubrication: Basic theory, Thick and thin film lubrication, Somerfield Number, Design consideration in hydrodynamic bearings, Raimondi and Boyd method relating bearing variables, Heat balance in journal bearings, Temperature rise	**6 Hrs**
Section – II		
Unit 4	**Design of Spur Gear**	
	Introduction to Gears: Gear terminology, Material selection, Types of gear failure. Spur Gear: Tooth loads, No. of teeth, Face width, Strength of gear teeth, Static beam strength (Lewis equation) Barth equation, Dynamic tooth load (spot's equation and Buckingham equation), Wear strength (Buckingham's Equation), Estimation of module based on beam strength and wear strength. Gear design for maximum power transmission capacity, Methods of gear lubrication.	**7 Hrs**
Unit 5	**Design of Helical and Bevel Gears**	
	Helical Gears: Formative number of teeth in helical gears, Force analysis, Beam and wear strength of helical gears, Effective load and design of helical gear. Bevel Gear: Straight tooth bevel gear terminology and geometrical relations, Guidelines for selection of dimensions and minimum number of teeth, Force analysis, Mounting of bevel gear and bearing reactions, Beam and wear strength, Dynamic tooth load, Design of straight tooth bevel gears based on beam and wear strength.	**6 Hrs**

Unit 6	**Design of Worm Gears**	
	Terminology and geometrical relations. Standard dimensions and recommendation of worm gearing, Force analysis, Friction, Efficiency of worm gear drive, Design of worm drive as per IS 7443-1974 based on beam strength and wear strength rating, Thermal consideration in worm drive.	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	---	--	--	--	--	2	--	--
CO2	2	1	3	--	2	--	--	--	--	--	--	--	1	--	--
CO3	1	2	3	2	2	--	--	--	--	--	--	--	1	--	--
CO4	1	2	2	3	--	--	--	--	--	--	--	--	3	--	--
CO5	1	2	2	3	2	--	--	--	--	--	--	--	3	--	--
CO6	1	2	2	3	2	--	--	--	--	--	--	--	3	--	--

References:

Text Books	
1	"Design of Machine Elements", V. B. Bhandari., Tata McGraw Hill Publication, 3rd Edition.
2	"Machine Design", R. K. Jain, Khanna Publication
3	"Machine Design A Basic Approach", Dr. S. S. Wadhwa, S S Jolly, Dhanapat Rai and Sons.
4	"A Text Book of Machine Design", R. S. Khurmi and J. K. Gupta.
Reference Books	
1	"Design of Machine Element", J. F. Shigley, Tata McGraw Hill Publication.
2	"Design of Machine Element" M. F. Spotts, Pearson Education Publication, 6th Edition.
3	"Machine Design", Black and Adams ,Tata McGraw Hill International.
4	"Machine Component Design", Robert C. Juvniall, Willey Ltd, 5th Edition.

ME604-INTERNAL COMBUSTION ENGINES

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	--	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is to

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

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Demonstrate engine construction, function of various parts of the engine and classify IC Engines.	Knowledge Understand
CO2	Identify different parts and systems of the engine along with its function	Apply
CO3	Explain the process of air and fuel induction in IC Engines.	Understand
CO4	Understand combustion process in IC engines and study the types of combustion chambers.	Understand Analyze
CO5	Perform engine testing and evaluate engine performance parameters.	Apply Evaluate
CO6	Predict impact of internal combustion engines on environment and ways to reduce them.	Analyze

Description:

This course studies the fundamentals of how the design and operation of internal combustion engines affect their performance, efficiency, fuel requirements, and environmental impact.

Prerequisites:	1:	Engineering Thermodynamics
	2:	Fluid Mechanics
	3:	Fluid and Turbo Machinery

Section – I		
Unit 1	**Introduction to I.C. Engines**	
	Classification of I. C. Engines, applications, Selection of IC Engine for different applications, Engine specifications, Engine cycles (Carnot, Otto, Diesel), Only numerical on Air standard cycles (Otto and Diesel cycles only), Deviation of actual cycles from air standard cycles, Valve timing diagram for high and low speed engine, Port timing diagram.	**6 Hrs**
Unit 2	**Fuel Systems for SI and CI Engines**	
	SI engines: Engine fuel requirements, complete carburetor, Derivation for calculation of A/F ratio, Calculation of main dimensions of carburetors (Only Approximate analysis numerical), Effect of altitude on Air fuel ratio. Fuel injection systems in SI engine, TBI, MPFI, GDI etc. diagram, merits and demerits. **CI 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, Calculations of main dimension of fuel injection system of diesel engine. **Engine management system (EMS):** Functional diagram of EMS, different components of EMS (ECU, alternator, throttle body assembly, mass flow sensor, throttle position sensor, temperature sensor, fuel injector, crank position sensor, camshaft sensor, fuel pump module, rollover sensor, lambda or oxygen sensor, air-fuel ratio sensor, coolant temperature sensor, manifold pressure sensor, speed sensor, hall effect switches, knock sensor, solenoids, relays etc. function of each component), merits and demerits of EMS. On board diagnostics (OBD) systems.	**8 Hrs**
Unit 3	**Combustion in S. I. Engines**	
	Stages of combustion, Ignition lag, Flame propagation, Factors affecting flame speed, Abnormal combustion, Influence of engine design and operating variables on detonation, Fuel rating, Octane number, Fuel additives, HUCR, Requirements of combustion chambers of S.I. Engines and its types.	**6 Hrs**
Section – II		
Unit 4	**Combustion in C.I. Engines**	
	Stages of combustion, 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	**6 Hrs**
Unit 5	**Performance Testing of Engines**	
	Performance parameters, Measurement of performance parameters like torque, power, Volumetric Efficiency, Mechanical Efficiency, BSFC, Brake and Indicated Thermal efficiencies. Numerical on Heat Balance Sheet and engine performance, Performance curves.	**6 Hrs**

Unit 6	**Engine Emission and Control**	
	Introduction to Supercharging and Turbo-charging, S.I. engine emission (HC, CO, NOx) Control methods- Evaporative (ELCD), Thermal, Catalytic converters, CI Engines Emission (CO, NOx, Smog, Particulate), Control methods- Chemical, EGR, Standard pollution Norms like EURO, Bharat, Introduction to alternative fuels for I.C. engines.	**8 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	--	--	--	--	--	---	--	--	--	--	--	2	--
CO2	2	2	--	--	--	--	--	--	--	--	--	--	--	2	--
CO3	3	3	3	--	--	--	--	--	--	--	--	--	--	2	--
CO4	2	1	--	--	--	--	--	--	--	--	--	--	--	2	--
CO5	3	3	3	--	--	--	--	--	--	--	--	--	--	2	--
CO6	2	1	1	--	--	3	3	--	--	2	--	--	--	2	--

References:

Text Books	
1	"Internal Combustion Engines", Ganesan. V., Tata McGraw Hill.
2	"A Course in Internal Combustion Engines", Mathur & Sharma, R. P. Dhanapat Rai. Publications.
3	"Internal Combustion Engines", Domkundwar, Dhanpat Rai Publication.
Reference Books	
1	"Internal Combustion Engines", J. B. Heywood, Tata McGraw Hill Publication.
2	"Engineering Fundamentals of the I. C. Engines", W. W. Pulkrabek , Pearson Education.
3	"Diesel and High Compression Gas Engines", P. M. Kates.

ME-L-605-INDUSTRIAL MANAGEMENT AND OPERATION RESEARCH

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	1 Hr/Week	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is able to

1. State various functions of management.
2. Know Production and marketing functional area of management.
3. Aware about norms of SSI, Industrial safety, MIS.
4. Apply Various Models of Operation Research Such as Linear Programming Model, Assignment Model, Transportation Model, Network Model and Sequencing Model.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Apply the concepts of Industrial management and operations research approaches. Know various functional areas of management.	Knowledge
CO2	Analyze issues in Managing operations and projects and various approaches to resolve those issues.	Understand
CO3	Understand MIS and Entrepreneurship Development	Understand Apply
CO4	Formulate and solve a wide variety of problems using Linear Programming Problems (LPP).	Apply
CO5	Formulate and solve a wide variety of problems using Transportation and Assignment problems.	Apply Evaluate
CO6	Implement the various techniques of Project Management such as Network Model and Sequencing Model to solve industrial problem .	Apply

Description:

Industrial Management and Operation Research course is offered as the basic management course. This course contains Mathematical methods and techniques that are used to solve complex Mechanical engineering problems. This course has six units namely -

Functions of Management, Functional areas of Management, Entrepreneurship Development, Introduction to Operations Research and Linear Programming Problems, Assignment Model and transportation model and Network model and sequencing.

Prerequisites:	1	Engineering Mathematics-I
	2	Engineering Mathematics-II

Section – I		
Unit 1	**Functions of Management**	
	Definition of Management, Planning –Objectives, steps in Planning, elements of planning, Organizing – Process of Organizing, principle of organizing, departmentation, Span of control. Staffing –Scope, Human resource management, Policies, Recruitment procedure, training and development, appraisal methods. Leading – Leadership style, Communication process, Barriers, remedies, Motivation, importance Herzberg's theory, Maslow's theory, McGregor's theory. Controlling– Process, Requirement for control management.	**8 Hrs**
Unit 2	**Functional areas of Management**	
	Production Management-Product mix, line balancing, break even analysis, Problem solving Techniques. Marketing Management –Principles & Functions, Types of Market, Market Research, Market Segmentation, Marketing Mix, and Advertisement.	**7 Hrs**
Unit 3	**Entrepreneurship Development**	
	Types of small scale industries (SSI), stages in starting SSI, Qualities required to be Entrepreneur, Government policies for SSI, Problems of SSI, Feasibility Report writing, Industrial Safety. Management Information System.	**5 Hrs**
Section – II		
Unit 4	**Introduction to Operations Research and Linear Programming Problems**	
	History and development of OR, OR models and their Applications, Formulation of LPP problem, Graphical solution of LPP, Simplex procedure for maximization, Simplex procedure for minimization, Duality concept.	**6 Hrs**
Unit 5	**Assignment Model and transportation model**	
	Assignment Model- Mathematical statement, Methods to solve balanced assignment problems, Unbalanced assignment problems, Maximization problems, Assignment with restrictions. Transportation model- Mathematical formulation, methods to obtain initial basic feasible solution (IBFS)- NWCR ,LCM and VAM, Conditions for testing optimality, MODI method for testing optimality of solution of balanced problems and unbalanced problems	**7 Hrs**
Unit 6	**Network model and sequencing**	
	CPM-Construction of network, Critical path, forward and backward Path, Floats and their significance. PERT- construction of networks, Time estimates, Probability of completing project by given date. Sequencing-Sequencing of n jobs & 2 machines, Sequencing of n jobs & 3 machines	**7 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	--	--	--	--	--	---	--	--	2	--	--	--	--
CO2	2	1	--	--	--	--	--	--	--	--	2	--	--	--	--
CO3	2	1	--	--	--	--	--	--	--	--	2	--	--	--	--
CO4	2	1	--	--	1	--	--	--	--	--	1	--	--	--	1
CO5	2	2	1	--	2	--	--	--	--	--	2	--	--	--	1
CO6	2	1	--	--	1	--	--	--	--	--	1	--	--	--	1

References:

Text Books	
1	"Industrial Engineering and Management", Vishwanath , Scitech Publication,1st Edition.
2	"Industrial Management and Operation Research", Nandkumar Hukeri, Electrotech Publication.
3	"Operations Research", J. K. Sharma, McMillan India Publication New Delhi,5th Edition
4	"Operations Research", Hira and Gupta, S. Chand and Co. New Delhi.
5	"Operation Research an Introduction", Hamdy A. Taha, Pearson,10th Edition
Reference Books	
1	"Management, Today – Principles and Practice", Gene Burton and Manab Thakur, Tata McGraw Hill Publishing Company, New Delhi.
2	"Essentials of Management", Koontz and H. Weinrich, Tata McGraw Hill Publication, 12th Edition.
3	"Business Management", J. P. Bose, S. Talukdar, New Central Agencies (P) Ltd.,
4	"Production and Operation Management", Tripathy, Scitech Publication, 2nd Edition.
5	"Management", James A.F. Stoner, R. Edward Freeman, Prentice Hall of India New Delhi.
6	"Introduction to Operation Research", Paneer-Selvam, Prentice Hall of India publication, 2nd Edition.
7	"Operation Research", Pradeep J. Jha, Tata McGraw Hill Publication.
8	"Operation Research", Mariappan, Pearson Education.
9	"Operation Research – Principle and Applications", G.Shriniwasan, Prentice Hall of India Publication, 3rd Edition.

Web Links/ Video Lectures

Lectures 1. https://nptel.ac.in/courses

2 https://onlinecourses.nptel.ac.in/noc21_ma62/preview

ME605- OEC-II SMART MATERIALS

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
			ESE	**:**	60 Marks

Course Objectives: The objective of the course is to

1. Study various types of smart materials used in engineering application
2. Study processing of smart materials
3. Study basics of sensors and its engineering application
4. Study basics of actuators and its engineering application

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand various smart material and its importance in engineering application	Knowledge Understand
CO2	Know various processing techniques of smart materials.	Knowledge
CO3	Get knowledge of use of smart material as sensors.	Understand Apply
CO4	Get knowledge of use of smart material as actuators.	Understand Apply
CO5	Select materials for sensor applications based on required properties.	Apply Evaluate
CO6	Evaluate shape memory materials, electro rheological fluids for newer applications	Apply

Description:

Smart materials, also called intelligent or responsive materials, are designed materials that have one or more properties that can be significantly changed in a controlled fashion by external stimuli, such as stress, moisture, electric or magnetic fields, light, temperature, pH, or chemical compounds. Smart materials are the basis of many applications, including sensors and actuators, or artificial muscles, particularly as electro active polymers (EAPs).

Prerequisites:	1:	Material Science and Metallurgy
	2:	Basic Mechanical Engineering

Section – I		
Unit 1	**Introduction**	
	Characteristics of metals, polymers and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of smart material	**7 Hrs**
Unit 2	**Smart Materials**	
	Piezoelectric materials, Electro-strictive Materials, Magneto-strictive materials, Magneto-electric materials, Magnetorheological fluids, Electrorheological fluids, Shape Memory materials	**6 Hrs**
Unit 3	**Processing of Smart Materials**	
	Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers	**7 Hrs**
Section – II		
Unit 4	**Sensors**	
	Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magneto-strictive sensors, Piezoresistive sensors, Optical sensors, Resonant sensors, semiconductor-based sensors, Acoustic sensors, polymerize sensors, Carbon nanotube sensors	**7 Hrs**
Unit 5	**Actuators-I**	
	Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers	**7 Hrs**
Unit 6	**Actuators-II**	
	Electro-strictive transducers, Magneto-strictive transducers, Electro thermal actuators, Comparison of actuation, Applications	**6 Hrs**

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	--	--	--	--	--	---	--	--	--	--	1	--	--
CO2	2	2	--	--	--	--	--	--	--	--	--	--	1	--	--
CO3	2	1	--	--	--	--	--	--	--	--	--	--	1	--	--
CO4	2	1	--	--	--	--	--	--	--	--	--	--	--	--	2
CO5	2	1	--	--	--	--	--	--	--	--	--	--	--	--	2
CO6	2	1	1	--	--	--	--	--	--	--	--	--	--	--	2

References:

Text Books	
1	Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006.
2	Smart Structures and Materials, Brain Culshaw, Artech House, London, 1996.
3	Smart Materials and Structures, Mukesh V. Gandhi, Brian S. Thompson, , Springer, May- 1992
Reference Books	
1	Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.
2	Smart Structures, P. Gauenzi, Wiley, 2009
3	Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, Berlin, New York, 2002
4	Analysis and Performance of Fiber Composites, B. D. Agarwal and L. J. Broutman, John Wiley & Sons.
5	Engineering aspects of Shape memory Alloys, T. W. Duerig, K. N. Melton, D. Stockel,C. Mayman, Butterworth – Heinemann, 1990.

Web Links/ Video Lectures

Lectures 1. https://nptel.ac.in/courses/112104173

2. https://nptel.ac.in/courses/112104251

3. www.iop.org/EJ/article/0964-1726/5/3/002/sm6301.ps.gz

ME601T- INDUSTRIAL FLUID POWER LAB

Practicals: 2 hrs / week **Examination Scheme:**

Credits: 1 **ISA:** 25 Marks

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Identify different hydraulic and pneumatic components.	Knowledge Understand
CO2	Understand and identify different ISO/JIC Symbols for hydraulic and pneumatic systems.	Understand
CO3	Understand and identify accumulators/actuators/intensifiers.	Understand
CO4	Design and assemble different hydraulic and pneumatic circuits.	Analyze

Practicals:

List of Assignments and Experiments:

Number	Practical/ Experiment/Tutorial Topic	Hrs.	Blooms Taxonomy
1	Study and Demonstration of basic hydraulic and pneumatic system.	2	Knowledge
2	Study and Demonstration of ISO/JIC Symbols for hydraulic and pneumatic systems.	2	Knowledge Understand
3	Study and Demonstration of different types of valves used in hydraulic and pneumatic system.	2	Knowledge Understand
4	Study and Demonstration of accumulators / actuators / intensifiers / hydraulic and pneumatic power brakes.	2	Knowledge Understand
5	At least five circuit preparations on hydraulic trainer kit	2	Analyze
6	At least five circuit preparations on pneumatic trainer kit.	2	Analyze
7	Industrial visits are recommended for applications of pneumatic and hydraulic system and their reports.	2	Analyze

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	--	3	--	--	--	1	--	--	--	2	--	--	1	2	--
CO2	3	--	--	--	2	1	--	--	--	1	--	1	1	2	--
CO3	3	--	--	--	1	--	--	--	1	2	--	--	1	2	--
CO4	3	--	--	--	--	1	--	--	--	2	--	--	1	--	--

References:

Text Books	
1	"Oil hydraulics Systems", S. R. Mujumdar, Tata McGraw Hill Publication.
2	"Pneumatic Systems", S. R. Mujumdar- Tata McGraw Hill Publication.
3	"Industrial Fluid Power", D. S. Pawaskar, Nishant Prakashan.
4	"Hydraulics and Pneumatics", Shaikh and Khan, R.K. Publication
5	"Fluid Power with Application", Esposito, Pearson Education, 7th Edition.

Links of V-Labs Practical

Sr. No.	Links
1	https://pc-coep.vlabs.ac.in/exp/direct-single-acting-cylinder/theory.html
2	http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/COEP_KNOWLEDGE_SEEKERS/ labs/exp1/index.html
3	https://www.youtube.com/watch?v=BVLY3SnX4JU

ME601T PROCESS PLANNING AND COST ESTIMATION LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE :NA

Course Objectives: The objective of the course is to
1. Understand the basic concept of process planning
2. Understand the different method of cost estimation in different manufacturing shops.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Prepare process planning activity chart& explain concept of Cost estimation.	Create
CO2	Compute the job order cost for different type of shop floor.	Analyze
CO3	Calculate the machining time for various machining operations.	Create and Analyze
CO4	Estimate the process costing and accounting required during industrial products.	Knowledge

Description:		
This course will also help in developing the skills required in Estimate production/operation cost for budgeting and analysis		
Prerequisites:	1:	Material Science and Metallurgy
	2:	Manufacturing Process and Manufacturing Technology
	3:	Manufacturing Engineering

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Case study of preparation of process planning chart of any one component in small scale industry (Machine Shop).	2	Analyze
2	Collect the finished parts from industries/market/scrap merchants Measure the dimensions and prepare production drawings of the parts using A4 size paper. Estimate the material cost	2	Create Analyze
3	Demonstration of method to estimate cost taking live demonstration at work shop place, steps based handouts	2	Knowledge

4	**Machining estimation:** a. Determine raw material volume for all machined parts. b. For each part, tabulate operation, cutting tool/s to be used and cutting parameters (speed, feed and depth of cut) to be used. c. Estimate raw material cost. d. For each part, estimate machining cost. Show the assumptions and steps followed to estimate machining cost. e. Derive total cost of parts	2	Create Analyze
5	Discussions, real life industries situation, industrial visits	2	Knowledge

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	---	--	--	--	--	--	--	2
CO2	1	2	3	--	--	--	--	--	--	--	--	--	--	--	1
CO3	-	2	3	--	--	--	--	--	--	--	--	--	--	--	1
CO4	1	--	3	--	--	--	--	--	--	--	--	--	--	--	1

References:

Text Books	
1	Product Design and Manufacturing, Chitale A.V. and Gupta R.C., 2nd ed., Prentice Hall 2002.
2	“Mechanical estimation and costing”, T. R. Banga and S. C. Sharma, Khanna publishers
3	“Mechanical Estimation”, Malhotra
4	“Industrial organization and Engineering Economics”, T. R. Banga and S. C. Sharma, Khanna publishers
5	Mechanical Estimation, NITTTR Chennai
6	"Mechanical costing and estimation”, Singh and Khan, Khanna Publishers
7	"Process planning & cost estimation" M. Adithan, New age International
Reference Books	
1	Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci. &Tech. 2002.
2	Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, 9th ed., John Wiley 1998.

ME602P - METROLOGY AND QUALITY CONTROL LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : 25

Course Objectives: The objective of the course is to

1. Study the use of various linear measuring instruments.
2. Study and understand the use of various comparators and angle measuring instruments.
3. Learn the use of floating carriage micrometer for screw thread measurement and the use of gear tooth Vernier caliper for spur gear measurement.
4. Study the use of optical flat for the measurement of flatness of the component and use of optical profile projector for the measurement of different features of the screw thread.
5. Study the use of Coordinate Measuring Machine to check the geometrical dimensions.
6. Study the capability of the process by using various control charts.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Use various linear and angular measuring instruments, comparators and select appropriate instrument for particular feature measurement.	Understand Evaluate
CO2	Understand working and use of various measuring instruments for screw threads and gear teeth.	Understand Apply
CO3	Apply the knowledge and the use of Coordinate Measuring Machine to check the geometrical dimensions.	Understand Apply
CO4	Understand and evaluate the capability of the process by using various control charts.	Analysis Evaluate

Description:

The Metrology and Quality Control laboratory consists of a number of measuring instruments, gauges and their use to check the dimensional features and physical dimensions of various components. Students are able to enhance their basic and fundamental knowledge of machine drawing to study the dimensional features and physical dimensions of the components and by selecting the appropriate measuring instrument they should able to check these dimensional features and physical dimensions of the various components used in the industry.

Prerequisites:	1:	Machine Drawing

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Study and use of linear measuring instruments.	2	Understand Apply
2	Study and use of comparators. (Practical use of pneumatic/mechanical comparator).	2	Understand Apply
3	Study and use of bevel protractor and sine bar for angle measurement.	2	Understand Apply
4	Study and use of floating carriage micrometer for screw thread measurement.	2	Understand Apply
5	Study and use of gear tooth Vernier caliper for spur gear measurement.	2	Understand Apply
6	Study and use of optical flat	2	Knowledge Understand
7	Study and use of use of optical profile projector	2	Understand Apply
8	Study and use of Coordinate Measuring Machine to check the geometrical dimensions.	2	Knowledge Understand
9	Assignment on control charts.	2	Analysis Evaluate

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	3	--	--	--	--	--	--	--	--	--	--	--	2
CO2	2	1	3	--	2	--	--	--	--	--	--	--	--	--	2
CO3	1	1	1	1	2	--	--	--	--	--	--	--	1	--	2
CO4	1	1	1	1	1	--	--	--	--	--	--	--	--	--	2

References:

Text Books	
1	"Engineering Metrology", I.C. Gupta, Dhanpat Rai Publications.
2.	"Engineering Metrology", R. K. Jain, Khanna Publisher.
3.	"Engineering Metrology", M. Mahajan, Dhanpat Rai and Sons.
4.	"Engineering Metrology and Measurements", N. V. Raghvendra and L. Krishnamurthy, Oxford University Press.
Reference Books	
1	"Practical Engineering Metrology", Sharp K.W.B. Pitman, London.
2	"Metrology and Measurements", A. K. Bewoor, Tata McGraw Hill Publication
3	"Metrology", Taher ELBS.
4	"Statistical Quality Control", A.L. Grant, Tata McGraw Hill International, New York. 6th Edition.
5	I.S. 919/1963., IS Fits for Basic Hole System, Part 1
6	I.S. 2709/1964., IS Fits for Basic Hole System, Part 2
7	"Engineering Metrology", Hume K.G., MC Donald, Technical and Scientific, London ,2nd Edition.

Video Lectures / Practicals
Practicals 1 to 8. https://nptel.ac.in/courses/112106179

ME603T–DESIGN OF MACHINE ELEMENTS LAB

Practicals : 2 hrs/ week
Credits : 1

Examination Scheme
ISA : 25 Marks
POE : NA

Course Objectives: The objective of the course is to

1.Design machine elements subjected to fluctuating loading.

2.Understand the standard nomenclature, forces, failures, application, design procedure of Spur, helical, bevel and worm gears (As per AGMA) and to determine standard geometry under given loading condition by using design data hand book and AGMA procedure.

3.Understand the different types of bearings, application, failures, design procedure of Ball Bearings (As per Manufacturer Catalog) and Sliding contact bearing and to determine standard design procedure of bearing under different loading condition by using design data hand book.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Evaluate the stresses in machine components due to various types of fluctuating loads and failure of components according to theories of failures.	Knowledge Understand
CO2	Analyze rolling contact bearing and its selection from manufacturer's catalogue	Knowledge Understand
CO3	Understand and apply principles of gear design to spur gears and industrial spur gear boxes.	Evaluate Analyze
CO4	Design of Helical, Bevel and Worm Gear for various industrial applications.	Analyze

Description:

The Design of Machine Elements-II laboratory syllabus consists of a design of gear box, selection of rolling contact bearing and design of components subjected to fluctuating loads.

Prerequisites:	1:	Analysis of Mechanical Elements
	2:	Material Science and Metallurgy
	3:	Applied Mechanics

Practicals :

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Construction of gears such as hub, web, arm, rim type etc. Design considerations of gear box	2	Evaluate Analyze
2	A detail design report and two sheets containing working drawing of details and assembly i) Spur gear/ Helical gear	2	Knowledge, Apply
3	A detail design report and two sheets containing working drawing of details and assembly ii) Bevel gear / Worm and Worm Wheel.	2	Knowledge, Apply
4	Assignments based on study of ball bearing mountings and its selection preloading of bearings.	2	Analyze Apply
5	Industrial visit based on above syllabus	2	Understand

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	--	--	--	--	--	--	--	--
CO2	1	2	3	--	--	--	--	--	--	--	--	1	2	--	1
CO3	1	2	3	--	--	--	--	--	--	--	--	1	2	--	1
CO4	--	2	3	--	--	--	--	--	--	--	--	1	2	--	1

References:

Text Books	
1	"Design of Machine Elements", V. B. Bhandari., Tata McGraw Hill Publication, 3rd Edition.
2	"Machine Design", R. K. Jain, Khanna Publication
3	"Machine Design A Basic Approach", Dr. S. S. wadhwa S S Jolly, Dhanapat Rai and Sons.
4	"A Text Book of Machine Design", R. S. Khurmi and J. K. Gupta.
Reference Books	
1	"Design of Machine Element", J. F. Shigley, Tata McGraw Hill Publication.
2	"Design of Machine Element" M. F. Spotts, Pearson Education Publication, 6th Edition.
3	"Machine Design", Black and Adams ,Tata McGraw Hill International.
4	"Machine Component Design", Robert C. Juvniall, Willey Ltd, 5th Edition.
5	SKF Bearing Manufacturers Catalogue
6	PSG Design data Book

ME604P INTERNAL COMBUSTION ENGINES LAB

Practicals : 2 hrs/ week
Credits : **1**

Examination Scheme
ISA : 25 Marks
POE : 25 Marks

Course Objectives: The objective of the course is to
1. Learn different parts of reciprocating IC engines and their functions. 2. Study various systems of IC engines like air intake, exhaust, lubrication and cooling. 3. Test the performance of IC engines with help of engine test rig.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Identity & demonstrate different components and systems of IC engines.	Apply
CO2	Understand functional details of engine systems.	Understand Apply
CO3	Evaluate the IC engines performance parameters by conducting experiments.	Evaluate Analyze
CO4	Measure engine emissions and study of emission norms.	Analyze

Description:

IC engines lab consists of a practical study of whole IC engines (different parts and systems) with help of demonstrative engines. The course also covers the testing of SI and CI engines and evaluation of performance of these engines for different performance parameters.

Prerequisites:	1:	Engineering thermodynamics
	2:	Fluid mechanics
	3:	Fluid and turbo machinery

Practicals:

Sr. No.	Practical Topic	Hrs.	Bloom's Taxonomy
1	Constructional detail of I.C. engines, dismantling and assembly.	2	Understand
2	Study and Demonstration of Engine systems: Air Intake, Exhaust, Cooling, Lubrication systems.	2	Understand
3	Study and Demonstration of Ignition systems, starting systems.	2	Apply
4	Study and Demonstration of Carburetor and Petrol injection system.	2	Apply
5	Study and Demonstration of fuel injection system of diesel engine.	2	Knowledge Understand
6	Study of engine management system of any car/motorcycle and detail report.	2	Understand Apply
Test group (Any five)			
7	Test on four stroke Diesel Engine.	2	Analyze Evaluate
8	Morse Test on Multi Cylinder Engine.	2	Analyze Evaluate
9	Test on variable compression ratio engine.	2	Analyze Evaluate
10	Test on computerized IC engine.	2	Analyze
11	Visit PUC center and submit PUC certificate photocopy of your own vehicle.	2	Understand Analyze
12	Visit to an engine manufacturing company / repairing unit.	2	Understand Analyze

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	1	--	--	--	--	--	---	--	--	--	--	--	3	--
CO2	3	1	--	--	--	--	--	---	3	2	--	2	--	3	--
CO3	3	1	--	--	--	--	--	---	3	2	--	2	--	3	--
CO4	3	2	--	--	--	--	2	---	3	3	--	3	--	3	--

References:

Text Books	
1	“Internal Combustion Engines”, Ganesan. V., Tata McGraw Hill.
2.	“A Course in Internal Combustion Engines”, Mathur & Sharma, R. P. Dhanapat Rai. Publications.
3.	“Internal Combustion Engines”, Domkundwar, Dhanpat RaiPublication.

Reference Books	
1	“Internal Combustion Engines”, J. B. Heywood,Tata McGraw Hill Publication.
2	“Engineering Fundamentals of the I.C.Engines”, W.W.Pulkrabek , Pearson Education.
3	“Internal Combustion Engines”, J. B. Heywood,Tata McGraw Hill Publication.
4	“Diesel and High Compression Gas Engines”, P. M.Kates.

ME306 T- CAD/CAM & 3D PRINTING LABORATORY

Practicals : 2 hrs / week
Credits : 1

Examination Scheme
ISA :50 Marks
POE : NA

Course Objectives: The objective of the course is to
1. Develop an ability to create constrained 2-D Sketches. 2. Create Solid Models of machine components. 3. Understand the concept of 3D Printing.

Course Outcomes:

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand and read engineering Drawings.	Understand
CO2	Prepare solid models from 2D drawings.	Apply
CO3	Prepare assemblies and BOM.	Apply
CO4	Understand the basics of Computer Aided Manufacturing and the concept of 3D Printing.	Understand Apply

Description:

The CAD/CAM & 3D Printing laboratory consists of CATIA software to make 2D and 3D object. Students will be able to enhance their basic and fundamental knowledge of machine drawing to make 2D and 3D models effectively.

Prerequisites:	1:	Machine Drawing
	2:	AutoCAD

Practicals:

No.	Practical Topic	Hrs.	Taxonomy
1	Solid Modeling- 4 exercises. (Printouts on A4 sheet)	2	Apply
2	Surface Modeling- 2 exercises. (Printouts on A4 sheet)	2	Apply
3	Drafting-Two exercises. (Printouts on A4 sheet)	2	Apply
4	Assembly drawing of at least 5 components. (Printout on A3 sheet)	2	Apply
5	Introduction of CAM. (Assignment)	2	Understand
6	Introduction of 3D Printing. (Assignment)	2	Understand Apply

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	--	3	--	--	--	1	--	--	--	2	--	--	1	2	--
CO2	3	--	--	--	2	1	--	--	--	1	--	1	1	2	--
CO3	3	--	--	--	1	-	--	--	1	2	--	--	1	2	--
CO4	3	--	--	--	--	1	--	--	--	2	--	--	1	--	--

References:

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.
Reference Books	
1.	CAD/CAM by M. P. Grover. and E. W. Zimmer, Prentice Hall of India Pvt. Ltd.
2.	CATIA V5R20 for Engineers and Designers, Prof. Shyam Tickoo and Deepak Maini, Dream Tech Press.
3.	CAD/CAM/CIM, Radhakrishnan, Subramanyam, Raju (2nd Ed.), New Age International Publishers.
4.	Respective Software manuals.
5.	CAD/CAM/CAE Chougule N.K SCITECH PUBLICATION.

ME607T – INDUSTRIAL TRIAINING

Practicals : --
Credits : 1

Examination Scheme
ISA : 50 Marks
POE : --

Course Objectives: The objective of the course is to
1. To familiar the students to realize an industrial work.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand and interpret the knowledge gained in the course work	Knowledge
CO2	Create, select, learn and apply appropriate techniques, resources, and modern engineering tools.	Apply
CO3	Develop the capability to work in team.	Analyze Create
CO4	Write technical report.	Apply Create

Description:

The students have to undergo an industrial training of minimum two weeks in an industry preferably dealing with Mechanical engineering during the semester break after Sixth semester and complete within 15 calendar days before the start of seventh semester. The students have to submit a report of the training undergone and present the contents of the report before the evaluation committee constituted by the department. An internal evaluation will be conducted for examining the quality and authenticity of contents of the report and award the marks at the end of the semester.

It is expected that students should undertake small assignment or work related to any of the course related aspect. Report is based on compilation of work carried out related to facility and layout planning, Industrial engineering- time study and motion study, Line efficiency evaluation and improvement, process capability evaluation, Industrial automation, process or machinery modification as identified.

Industrial Training Report Format	Maximum fifteen students in one batch, involving three groups of maximum five students, shall work under one teacher. The same group shall work for project under the same guide. However, each student should have different industrial training and its presentation. The report should be of 30 to 35 pages. For standardization of the report 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 Pt. font 7. Line Spacing : 1.5 lines 8. Page Numbers : Right aligned at footer. Font 12 Pt. Times New Roman 9. Headings : New Times Roman, 14 Pt., Bold face 10. Certificate : All students should attach standard format of Certificate as prescribed by the department. Certificate should be awarded preferably to batch and not for individual student. However, certificate for individuals in exceptional cases with permission of concern guide will be considered. It should have signatures of Guide, Head of Department and Principal.

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	1	2	3	2	1	3	--	3
CO2	1	2	2	1	2	1	1	2	2	2	2	1	2	1	2
CO3	1	2	2	2	1	2	1	2	3	2	3	1	1	--	1
CO4	1	3	1	3	2	1	3	--	1	3	--	--	1	1	1

ME608T - MINI-PROJECT PHASE -II

Practicals : 1 hrs/ week
Credits : 1

Examination Scheme
ISA : 50 Marks
POE : NA

Course Objectives: The objective of the course is to

1. To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc. thereby enhancing the skill and competency part of technical education.
2. To inculcate innovative thinking and thereby preparing students for main project.
3. To familiarize the process of solving the problem in a group.

Course Outcomes:

Cos	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify small real engineering and societal problems through different types of surveys (Literature survey, Industrial survey etc.)	Understand Knowledge
CO2	Solve and Analyze these problems by using software / analytical / computational tools and techniques by applying engineering principles.	Apply Analyze
CO3	Develop model / technical reports with presenting skills to defend their work in front of technically qualified audience.	Evaluate Create
CO4	Develop problem solving capabilities by self-learning in a team as well as an individual, which leads to lifelong learning.	Analyze

Description:

The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, society and academic institutions. Each student of the project group shall involve in carrying out the project work jointly in constant consultation with guide, batch Incharge and prepare the project report as per the norms provided them.

Prerequisites:	1:	Engg. Mathematics, Engg. Physics, Engg. Chemistry
	2:	Basic Knowledge of Mechanical Engg.

Practical's:

Guidelines and Activities for Mini Project throughout year	
First Semester Activities	
Allotment of Batch in charge and Guide	Department will provide you batch in charge for every batch in the time table. Allotted faculty takes care of whole batch throughout semester. Also after formation of group, project guide will be allotted to each group by department for throughout year. He will be entirely guide you, starting from the selection of topic to the completion. Batch in-charge will keep the record of entire batch during practical hours. He will also coordinate the activity along with guide and project coordinator.
Group formation	Group should be formed within the Batch of 4 to 5 students in one group, not more than that
Topic Selection	By doing the discussion along with your concerned guide. Group should decide the topic for Mini Project. ***Project work shall be based on any of following 1. Design and development/fabrication of small setup/model 2. Theoretical/Software analysis of any small mechanical system/subsystem of large system 3. Testing and analysis of small mechanical system 4. Software program for any mechanical system design or analysis 5. Industrial survey of any mechanical systems, data collection and analysis
Literature review	After selection of topic student should collect related information by searching and xeroxing/ downloading the journal paper from various sources. Also xeroxing the reference books pages related to their topic.
Synopsis Writing	This is important activity of this semester. Synopsis is blueprint/plan of your mini project. With the help of your guide you have to write synopsis in department given format.
Progress presentation	In the middle of semester student should give the presentation on synopsis in front of guide and batch incharge.
Expected work in Semester - I	Each project group must complete, minimum these activities at the end of first semester 1) Synopsis writing 2) Literature Review Chapter (6- 8 pages) 3) Theoretical Design on Paper
Final Presentation of Mini Project semester I	At the end of semester, each group will give presentation on project work of this semester in front of guide, batch in-charge and one more faculty from department. This presentation will be assessed for 25 Marks internal term work. You have to submit two hard copies of your synopsis report to the department along with you have to show the project diary** and literature review file***

Second Semester Activities	
Continuation of Work	Same group with same guide continued their previous semister work in next semister it is expected that at least 30 percent work should completed in first semester
Fabrication and Testing of model/Theoretical analysis /Surveying analysis/Testing of software program	Complete core part of your project as above under the instructions of guide
Presentation of your work in the form of project report	Writing the Project report of 20 to 25 pages in standard format given by department.
Progress presentation	In the middle of semester student should give the progress presentation in front of guide and batch in charge.
Final Presentation of Mini Project semester II	At the end of semester, Students have to give Project Report presentation in front of guide, batch in-charge and one more faculty from department. This presentation will be assessed for 25 Marks internal term work. Every project group should have to submit two hard copies of good quality project reports to the department along with submission of the project diary and literature review file.
Sponsored Project/Participated Project in Project/Paper competition	Sponsored project and project which is participated in project competition/Paper presentation, three bonus Marks shall be considered, in the final term work calculations.
**** Project Diary**	It is simple note book in which students should keep the record of meetings, along with guide and their discussion about mini project. Also you have to maintain the record of rough calculations, drawings and observations of your project.

*** **Literature file**	Collect all the information or material related to your topic (Xerox or printout of journal papers, reference books, Hand books, internet materials etc.) in one file.
Project Report Format:	Project report should be of 10 to 15 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. References: References should have the following format a. For books: “Title of Book”, Authors, Publisher, Edition b. For Papers: “Title of Paper”, Authors, Journal/Conference Details, Year

Mapping of POs & COs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	3	--	--	--	--	--	2	--	--
CO2	1	3	3	2	3	--	2	2	--	--	--	--	3	1	3
CO3	--	--	--	--	--	2	3	1	1	3	--	--	--	--	--
CO4	--	--	--	--	--	--	2	---	3	--	3	3	--	--	--

Video Lectures / Practicals

https://www.youtube.com/watch?v=-IiEzaKE_I
https://www.youtube.com/watch?v=Hj15c7Jog4k
https://www.youtube.com/watch?v=0oSDa2kf5I8

ME609A- AUDIT COURSE-VI

Practicals : ---
Credits : Non - Credit

Examination Scheme
ISA : ---
Audit Point : 2

Course Objectives:

In today's highly competitive world, students have to bear a lot of mental stress to overcome from this they have to get involved in various extracurricular activities help us get mental rest and also stay physically fit. It helps students to maintain social interaction, healthy recreation, self-discipline and self-confidence. And it is very essential for students to succeed in their future career.

Course Particulars :

Any one Extracurricular Activity participation.

1) Sport Activity

2) Cultural Activity

3) Social Activity

4) NSS Participation etc.

(No semester bounding to Complete)

APPROVED BY

Member Secretary
Board of Studies

Chairman
Board of Studies

Chairman
Board of Studies
MECHANICAL ENGG. DEPT
Yasaheb Kore Institute of Engg
& Technology (Autonomous)
Warananagar, Dist. Kolhapur

Academic Dean
T.K.I.E.T., Warananagar

Principal
T.K.I.E.T., Warananagar

Chairman
Academic Council
Yatyasaheb Kore Institute of Engg.
& Technology (Autonomous)
Warananagar, Dist. Kolhapur

YASHWANTRAO BHONSALE KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
WARANANAGAR
Dist. Kolhapur

Seal of Institute