SEMESTER V

S. No.	Course Code	Course title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	CME391	Design for Manufacturing	PCC	3	0	0	3	3
2.	CME380	Automobile Engineering	PCC	3	0	0	3	3
3.	CME399	Operational Research	PCC	3	0	0	3	3
4.	CME382	Composite Materials and Mechanics	PCC	3	0	0	3	3
5.	CME390	Thermal Power Engineering	PCC	3	0	0	3	3
PRACTICALS								
6.	MS3511	Metallurgy Laboratory	PCC	0	0	4	4	2
7.	MS3512	Industrial Training III	EEC	0	0	0	0	2
			TOTAL	**15**	**0**	**4**	**19**	**19**

SEMESTER VI

S. No.	Course Code	Course title	Cate Gory	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	MS3601	Instrumentation and Control Systems	PCC	4	0	0	4	4
2.	CME389	Design of Transmission System	PCC	3	0	0	3	3
3.	CME387	Non-traditional Machining Processes	PCC	3	0	0	3	3
4.	CME396	Process Planning and Cost Estimation	PCC	3	0	0	3	3
5.	CPR332	Finite Element Analysis	PCC	3	0	0	3	3
PRACTICALS								
6.	MS3611	Computer Aided Engineering Laboratory	PCC	0	0	4	4	2
7.	MS3612	Design and Fabrication Project	EEC	0	0	4	4	2
8.	MS3613	Industrial Training IV	EEC	0	0	0	0	2
			TOTAL	**16**	**0**	**8**	**24**	**22**

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

form error, material of construction and to understand the product development skills for lathes, drilling machines, submersible pumps, mono block pumps& electric motors - Comparison of design construction of other makes for above products and analysis -To develop any new product with innovation & creativity - Report preparation, presentation and evaluation -Awareness of TQM, ISO9000, ISO14000 and other standards etc. - Process capability studies – Rejection analysis – Six sigma applications – Calibration needs – Calibration authorities – Records – Charts – Applications – Form error understanding and verification- Case studies in quality systems.

MS3601	INSTRUMENTATION AND CONTROL SYSTEMS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

1 To impart knowledge on measurements and variables
2 To introduce different parameters in environment and measuring techniques
3 To familiarise the working principle of temperature, pressure, vibration and flow measurement sensors.
4 To teach the control system principle and build times response of different system

UNIT I TRANSDUCER VARIABLES AND MEASUREMENT SIGNALS 10

Three stages of generalized measurement system – mechanical loading – static characteristics of instruments- factors considered in selection of instruments – commonly used terms, error analysis and classification – sources of error – frequency response – displacement transducers – potentiometer, strain gauge – orientation of strain gauge, LVDT – variable reluctance transducers, proximity sensors, capacitance transducers, tacho generator; smart sensors, integrated sensors, radio telemetry, torque measurements, precision systems like video discs and drives, laser printer etc

UNIT II VIBRATION AND TEMPERATURE 9

Elementary accelerometer and vibrometer – seismic instrument for acceleration – velocity measurement, piezo electric accelerometer, temperature measurement-liquid in glass thermometer, pressure thermometer, resistance temperature detector, themcouples and thermopiles, thermistor, total radiation pyrometer, optical pyrometer – temperature measuring problem in flowing fluid.

UNIT III PRESSURE AND FLOW MEASUREMENT 9

Manometer, elastic transducer, elastic diaphragm transducer – pressure cell, bulk modulus pressure gauge – Mc Leod gauge – thermal conductivity gauge, calibration of pressure gauge, flow measurement – turbine type meter, hotwire anemometer, magnetic flow meter; liquid level sensors, light sensors, selection of sensors.

UNIT IV CONTROL SYSTEM PRINCIPLE 16

Basic elements of control systems – open loop and closed loop control – elements of closed loop control system – introduction to sampled data, digital control and multivariable control systems. Elements of lead and lag compensation, elements of proportional, integral - derivative (PID) control.

MODELLING OF SYSTEMS: Mathematical Model for mechanical and electrical system - Transfer function – transfer function of hydraulic and pneumatic elements – flapper valve. Transfer function of D C Generator, DC servomotor and AC servomotors, tacho generators, gear trains, potentiometers, synchros – Transfer function of closed loop systems: determination of transfer function for position control, speed control system, temperature control system – block diagram reduction and signal flow graph

UNIT V SYSTEM ANALYSIS 16

Typical test signals – time domain specifications – characteristic equation, time response of first order and second order systems for step input – stability and roots of characteristic equations – roots of characteristic equations – Routh Hurwitz stability concepts. SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA): Overview, architecture, tools alarm, tag logging, history, report generation. Communication protocols of SCADA, interfacing SCADA with field devices. Distributed Control Systems (DCS), architecture, communication facilities, operator and engineering interfaces.

TOTAL:60 PERIODS

OUTCOMES: Upon the completion of this course the students will be able to

1. Classify uncertainties in measurement data and review various measurement signals.
2. Explain the working principle of temperature, pressure, vibration and flow measurement sensors
3. Understand the concept of instrumentation which can be applied to integrate the same with control systems
4. Apply control system principle and illustrate the use of the sensor to design close loop system
5. Develop appropriate mathematical model for mechanical and electrical system.

TEXT BOOKS:

1. Beckwith T G and Buck N L, “Mechanical Measurements”, Addition Wesley Publishing Company Limited, 1995.
2. Gopal M, “Control Systems – Principles and Design”, Tata McGraw Hill Co. Ltd., New Delhi, 2002.
3. Michael P Lukas, “Distributed Control Systems”, Van Nostrand Reinfold Company, 1995.

REFERENCES:

1 Alan S Morris, “Measurement and Instrumentation Principles”, Butterworth, 2006.
2 Dominique Placko, “Fundamentals of Instrumentation and Measurement”, ISTE, 2007.
3 Jain R K, “Mechanical and Industrial Measurements”, Khanna Publishers, Delhi, 1999
4 Regtien PPL, “Measurement Science for Engineers”, Kogan Page, 2005.
5 Rangan, Mani and Sharma, “Instrumentation”, Tata McGraw Hill Publishers, New Delhi, 2004
6 Nagarath I J and Gopal M, “Control Systems Engineering”, New Age International Publishers, 2007

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	1		1		1			1		2	2		
2	3	2	1		1		1			1		2	2		
3	3	2	1		1		1			1		2	2		
4	3	2	1		1		1			1		2	2		
5	3	2	1		1		1			1		2	2		
Low (1) ; Medium (2) ; High (3)															

CME389 DESIGN OF TRANSMISSION SYSTEM

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1 To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
2 To understand the standard procedure available for Design of Transmission of Mechanical elements spur gears and parallel axis helical gears.
3 To learn the design bevel, worm and cross helical gears of Transmission system.
4 To learn the concepts of design multi and variable speed gear box for machine tool applications.
5 To learn the concepts of design to cams, brakes and clutches

(Use of P S G Design Data Book permitted)

UNIT – I DESIGN OF FLEXIBLE ELEMENTS 9

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT – II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces for helical gears.

UNIT – III BEVEL, WORM AND CROSS HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT – IV GEAR BOXES 9

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT – V CAMS, CLUTCHES AND BRAKES 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

Total:45 periods

OUTCOMES: At the end of the course the students would be able to

1. Apply the concepts of design to belts, chains and rope drives.
2. Apply the concepts of design to spur, helical gears.
3. Apply the concepts of design to worm and bevel gears.
4. Apply the concepts of design to gear boxes.
5. Apply the concepts of design to cams, brakes and clutches

TEXT BOOKS:

1. Bhandari V, “Design of Machine Elements”, 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, “Design of Machine Elements” 8th Edition, Printice Hall, 2003.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Edition, Wiley,2005
5. Sundararajamoorthy T. V, Shanmugam .N, “Machine Design”, Anuradha Publications,Chennai, 2003.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	1					1			1	2	3	2
2	3	2	3	1					1			1	2	3	2
3	3	2	3	1					1			1	2	3	2
4	3	2	3	1					1			1	2	3	2
5	3	2	3	1					1			1	2	3	2
Low (1) ; Medium (2) ; High (3)															

CME387	NON-TRADITIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To classify non-traditional machining processes and describe mechanical energy based non-traditional machining processes.
2. To differentiate chemical and electro chemical energy-based processes.
3. To describe thermo-electric energy-based processes
4. To explain nano finishing processes.
5. To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes

UNIT – I INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES 9

Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

UNIT – II CHEMICAL AND ELECTRO CHEMICAL ENERGY BASED PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Chemical machining, Electro-chemical machining, Electro-chemical honing, Electro-chemical grinding, Electro chemical deburring.

UNIT – III THERMO-ELECTRIC ENERGY BASED PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

UNIT – IV NANO FINISHING PROCESSES 9

Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magnetorheological finishing, Magneto rheological abrasive flow finishing.

UNIT – V HYBRID NON-TRADITIONAL MACHINING PROCESSES 9

Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

TOTAL:45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Formulate different types of non-traditional machining processes and evaluate mechanical energy based non-traditional machining processes.
2. Illustrate chemical and electro chemical energy based processes.
3. Evaluate thermo-electric energy based processes.
4. Interpret nano finishing processes.
5. Analyse hybrid non-traditional machining processes and differentiate non- traditional machining processes.

TEXT BOOKS:

1. Adithan. M., “Unconventional Machining Processes”, Atlantic, New Delhi, India, 2009. ISBN 13: 9788126910458

2. Anand Pandey, “Modern Machining Processes”, Ane Books Pvt. Ltd., New Delhi, India, 2019.

REFERENCES:

1. Benedict, G.F., “Non-traditional Manufacturing Processes”, Marcel Dekker Inc., New York 1987. ISBN-13: 978-0824773526.
2. Carl Sommer, “Non-Traditional Machining Handbook”, Advance Publishing., United States, 2000, ISBN-13: 978-1575373256.
3. Golam Kibria, Bhattacharyya B. and Paulo Davim J., “Non-traditional Micromachining Processes: Fundamentals and Applications”, Springer International Publishing., Switzerland, 2017, ISBN:978-3-319-52008-7.
4. Jagadeesha T., “Non-Traditional Machining Processes”, I.K. International Publishing House Pvt. Ltd., New Delhi, India, 2017, ISBN-13: 978-9385909122.
5. Kapil Gupta, Neelesh K. Jain and Laubscher R.F., “Hybrid Machining Processes: Perspectives on Machining and Finishing”, 1st edition, Springer International Publishing., Switzerland, 2016, ISBN-13: 978-3319259208.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3		1		1		1		1	1		1	2	2	2
2	3		1		1		1		1	1		1	2	2	2
3	3		1		1		1		1	1		1	2	2	2
4	3		2		1		1		1	1		1	2	2	2
5	3		3		3		1		1	1		1	3	3	3
Low (1) ; Medium (2) ; High (3)															

CME396 PROCESS PLANNING AND COST ESTIMATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1 To introduce the process planning concepts to make cost estimation for various products after process planning
2 To Learn the various Process Planning Activities
3 To provide the knowledge of importance of costing and estimation.
4 To provide the knowledge of estimation of production costing.
5 To learn the knowledge of various Machining time calculations

UNIT – I INTRODUCTION TO PROCESS PLANNING 9

Introduction- methods of process planning-Drawing Interpretation-Material evaluation – steps in process selection-. Production equipment and tooling selection

UNIT – II PROCESS PLANNING ACTIVITIES 9

Process parameters calculation for various production processes-Selection jigs and fixture selection of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT – III INTRODUCTION TO COST ESTIMATION 9

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of overhead charges- Calculation of depreciation cost

UNIT – IV PRODUCTION COST ESTIMATION 9

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop,Estimation of Foundry Shop

UNIT – V MACHINING TIME CALCULATION **9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling,Shaping and Planning -Machining Time Calculation for Grinding.

Total:45 periods

OUTCOMES: At the end of the course the students would be able to

1. Discus select the process, equipment and tools for various industrial products.
2. Explain the prepare process planning activity chart.
3. Explain the concept of cost estimation.
4. Compute the job order cost for different type of shop floor.
5. Calculate the machining time for various machining operations.

TEXT BOOKS:

1. Peter scalon, “Process planning, Design/Manufacture Interface”, Elsevier science technology Books, Dec 2002.
2. Sinha B.P, “Mechanical Estimating and Costing”, Tata-McGraw Hill publishing co, 1995.

REFERENCES:

1. Chitale A.V. and Gupta R.C., “Product Design and Manufacturing”, 2nd Edition, PHI, 2002.
2. Ostwalal P.F. and Munez J., “Manufacturing Processes and systems”, 9th Edition, John Wiley,1998.
3. Russell R.S and Tailor B.W, “Operations Management”, 4th Edition, PHI, 2003.
4. Mikell P. Groover, “Automation, Production, Systems and Computer Integrated Manufacturing”,Pearson Education 2001.
5. K.C. Jain & L.N. Aggarwal, “Production Planning Control and Industrial Management”, KhannaPublishers 1990.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2					1		1	1	2	1	1
2	3	3	2	1					1		1	1	2	1	1
3	3	3	2	2					1		1	1	2	1	1
4	3	3	2	2					1		1	1	2	1	1
5	3	3	2	2					1		1	1	2	1	1
Low (1) ; Medium (2) ; High (3)															

CPR332 **FINITE ELEMENT ANALYSIS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Developing mathematical models for Boundary Value Problems and their numerical solution.
2. Applying concepts of Finite Element Analysis to solve one dimensional problem.
3. Determining field variables for two dimensional scalar variable problems.
4. Determining field variables for two dimensional vector variable problems.
5. Applying the need for Isoparametric transformation and the use of numerical integration.

UNIT I INTRODUCTION **9**

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems–

Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics including thermal stresses-heat transfer. Natural frequencies of longitudinal vibration and mode shapes. Fourth Order Beam Equation –Transverse deflections and Transverse Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements and Quadrilateral elements- Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Constitutive matrices and Strain displacement matrices – Stiffness matrix – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS 9

Natural co-ordinate systems – Isoparametric elements – Shape functions for isoparametric elements – One and two dimensions – Serendipity elements – Numerical integration - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software- Introduction to Non Linearity.

TOTAL = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Develop mathematical models for Boundary Value Problems and their numerical solution
2. Apply concepts of Finite Element Analysis to solve one dimensional problems
3. Determine field variables for two dimensional scalar variable problems
4. Determine field variables for two dimensional vector variable problems
5. Apply the need for Isoparametric transformation and the use of numerical integration

TEXT BOOKS:

1. Rao, S.S., “The Finite Element Method in Engineering”, 6th Edition, Butterworth-Heinemann,2018.
2. Reddy,J.N. “Introduction to the Finite Element Method”, 4th Edition, Tata McGrawHill,2018.

REFERENCES:

1. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGrawHill, 2005
2. Dhanaraj. R and Prabhakaran Nair. K, “Finite Element Analysis”, Oxford Publications, 2015.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2004.
4. Seshu.P, “Text Book of Finite Element Analysis”, PHI Learning Pvt. Ltd., NewDelhi, 2012.
5. Tirupathi R. Chandrupatla and Ashok D. Belegundu, “Introduction to Finite Elements in Engineering”, International Edition, Pearson Education Limited, 2014.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	3	2						2		3	2	2
2	3	2	3	3	2						2		3	2	2
3	3	2	3	3							2		3	2	2
4	3	2	3	3							2		3	2	2
5	3	2	3	3	2						2			2	1

Avg	3	2	3	3	2						2		3	2	1.8

MS3611 **COMPUTER AIDED ENGINEERING LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To expose the students in the usage of software for modeling and analysis of machine components.

LIST OF EXPERIMENTS:

1. Solid modeling of engineering components of a typical assembly and extraction of production drawings of the above components and assembly.
2. Determination of stresses and factor of safety in critical machine components by FEM and experimental validation of the results by strain measurement.
3. Dynamic analysis of chassis frame of an automobile.
4. Thermal analysis of IC engine components using FEA software.
5. Crash analysis of an automobile using FEA software.
6. Kinematic and dynamic analysis of mechanisms using mechanism analysis software.
7. Thermal Analysis of electronic equipments.
8. Analysis of flow through pipes using CFD software.
9. Simulation of stamping process using metal forming software.
10. Tolerance stack up using simulation software.

TOTAL: 60 PERIODS

OUTCOMES:

- Exposed to use CAD software for creating wire frame and solid models of machine parts
- Ability to conduct kinematic and dynamic simulations of mechanisms
- Knowledge in using softwares for Crash/Impact, flow analysis.
- Usage of FEA softwares in mechanical and thermal load analysis

ME3612 **DESIGN AND FABRICATION PROJECT** **L T P C**
0 0 4 2

OBJECTIVE:

- The main objective is to give an opportunity to the student to get hands on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL : 60 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1 design and Fabricate the machine element or the mechanical product.
CO2 demonstrate the working model of the machine element or the mechanical product.

MS3613	INDUSTRIAL TRAINING IV	L	T	P	C
	(DESIGN AND PRODUCTION OF CASTINGS)	0	0	0	2

Foundry practice, design knowledge of patterns, Moulds, Cores (Mini Project – II), Layout, Pattern shop - Sand plant - Machine moulding - Core shop - Heavy moulding – furnaces -melting-knock-out and shot blasting - fettling -Study of various casting designs-Metallurgy -Inspection-Semi Automation processes-Sand reclamations-Preservations-Rough Machining-Various allowances-Method Engineering-Computational applications-Planning & Scheduling-Costing-Cleanliness-Orderliness- Environmental requirements-Safety needs-Energy Conservations-Bio Mass Power Generators-DISA Machine operations-Material Handling techniques-Case studies for few selected casting to understand steps to design plan right from pattern to finish casting. Inspection of casting, casting defects and remedies, cause and effects diagram, Rejection analysis.

ME3591	DESIGN OF MACHINE ELEMENTS	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES
1 To learn the various steps involved in the Design Process.
2 To Learn designing shafts and couplings for various applications.
3 To Learn the design of temporary and permanent Joints.
4 To Learn designing helical, leaf springs, flywheels, connecting rods and crank shafts for various applications.
5 To Learn designing and select sliding and rolling contact bearings, seals and gaskets.
(Use of PSG Design Data book is permitted)

UNIT – I FUNDAMENTAL CONCEPTS IN DESIGN 12
Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers- Direct, Bending and torsional loading- Modes of failure - Factor of safety – Combined loads – Principal stresses – Eccentric loading – curved beams – crane hook and 'C' frame- theories of failure – Design based on strength and stiffness – stress concentration – Fluctuating stresses – Endurance limit –Design for finite and infinite life under variable loading - Exposure to standards.

UNIT – II DESIGN OF SHAFTS AND COUPLINGS 12
Shafts and Axles - Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys and splines – Rigid and flexible couplings.

UNIT – III DESIGN OF TEMPORARY AND PERMANENT JOINTS 12
Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints-Butt, Fillet and parallel transverse fillet welds – welded joints subjected to bending, torsional and eccentric