SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E-Mechanical Engineering

(Engineering Design)

CURRICULUM and SYLLABI

[For students admitted in 2018-2019]

M.E / M.Tech Regulation 2015

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END101	Advanced Numerical Methods	3	2	0	4
2	P15END102	Computer Applications in Design	3	0	0	3
3	P15END103	Finite Element Analysis	3	2	0	4
4	P15END104	Concepts of Engineering Design	3	0	0	3
5	P15END105	Micro Electro Mechanical Systems Design	3	0	0	3
6	P15END501	**Professional Elective**- Rapid Prototyping and Tooling	3	0	0	3
Practical						
7	P15END106	CAD Laboratory	0	0	4	2
					Total Credits	**22**

Approved by

Chairman, Mechanical Engineering BOS Dr.D.Senthilkumar

Member Secretary, Academic Council Dr.A.C.Kaladevi

Chairperson, Academic Council & Principal Dr.M.Usha

Copy to:-
HOD/MECH, First Semester ME END Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME II Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END201	Mechanical Vibrations	5	0	0	5
2	P15END202	Integrated Product And Processes Development	5	0	0	5
3	P15END203	Advanced Mechanisms Design And Simulation	5	0	0	5
4	P15END204	Design For Manufacture And Assembly	5	0	0	5
5	P15END520	**Professional elective**-Industrial Robotics And Expert Systems	5	0	0	5
6	P15END523	**Professional elective**- Productivity Management And Re-Engineering	5	0	0	5
Practical						
7	P15END205	Analysis And Simulation Laboratory	0	0	6	3
					Total Credits	**33**

Approved by

Chairman, Mechanical Engineering BOS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END506	**Elective-** Mechanics Of Composite Materials	3	0	0	3
2	P15END521	**Elective-** Mechatronics System Design	3	0	0	3
3	P15END524	**Elective-** Product Data Management	3	0	0	3
Practical						
4	P15END301	Project Work Phase - I	0	0	12	6
					Total Credits	**15**

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Copy to:-
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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Practical						
1	P15END401	Project Work Phase – II	0	0	30	15
					Total Credits	**15**

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Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/MECH, Fourth Semester ME END Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END101	Advanced Numerical Methods	3	2	0	4
2	P15END102	Computer Applications in Design	3	0	0	3
3	P15END103	Finite Element Analysis	3	2	0	4
4	P15END104	Concepts of Engineering Design	3	0	0	3
5	P15END105	Micro Electro Mechanical Systems Design	3	0	0	3
6	P15END501	**Professional Elective**- Rapid Prototyping and Tooling	3	0	0	3
Practical						
7	P15END106	CAD Laboratory	0	0	4	2
					Total Credits	**22**

Approved by

Chairman, Mechanical Engineering BOS Dr.D.Senthilkumar

Member Secretary, Academic Council Dr.A.C.Kaladevi

Chairperson, Academic Council & Principal Dr.M.Usha

Copy to:-
HOD/MECH, First Semester ME END Students and Staff, COE

Course Code	**P15END101**	L	T	P	C
Course Name	**ADVANCED NUMERICAL METHODS**	3	2	-	4

Pre-requisite subjects: Mathematics I & II, Transforms and Partial Differential Equations and Numerical Methods

Course Outcomes

Upon completion of this course the students will be able to

CO1	Apply numerical methods for algebraic or transcendental equation
CO2	Apply numerical technique for solving IVPs and BVPs in ODEs and characteristics value problem by using suitable method
CO3	Describe and obtain the solution of partial differential equations that are time-dependent
CO4	Describe and obtain the solution of partial differential equations that are time-independent
CO5	Explain the concept of finite element method, orthogonal collocation method, orthogonal collocation with finite element method and Galerkin finite element method for solving PDEs

Unit I ALGEBRAIC EQUATIONS L 9 T 6

Systems of linear equations: Gauss Elimination method, pivoting techniques – Jacobi, Gauss Seidel, SOR iteration methods - Systems of nonlinear equations: Fixed point iterations, Newton Method, Eigenvalue problems: power method, inverse power method.

Unit II ORDINARY DIFFERENTIAL EQUATIONS L 9 T 6

RungeKutta Methods for system of IVPs, numerical stability, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

Unit III FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL QUATIONS L 9 T 6

Parabolic equations: explicit and implicit finite difference methods, weighted average approximation - Dirichlet and Neumann conditions - Two dimensional parabolic equations – ADI method; First order hyperbolic equations – method of characteristics.

Unit IV FINITE DIFFERENCE METHOD FOR TIME INDEPENDENT PARTIAL DIFFERENTIAL EQUATIONS L 9 T 6

Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

Unit V FINITE ELEMENT METHOD L 9 T 6

Partial differential equations – Finite element method - orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

Tutorials: 30 Hrs
Total : 75 Hrs

Content Beyond Syllabus

1. Thomas algorithm for tridiagonal system
2. Faddeev – Leverrier Method
3. Adams-Bashforth multistep method
4. Method of lines
5. Cranck-Nicholson Method
6. Wave equation- Explicit scheme

Learning Resources

Reference books

1. SaumyenGuha and Rajesh Srivastava, "Numerical methods for Engineering and Science", Oxford Higher Education, New Delhi, 2010.*ISBN*-13: 978-0195693485.
2. Gupta S.K., "Numerical Methods for Engineers", New Age Publishers, 3rd edition, 2015.ISBN-978-81-224-3359-3.
3. Burden, R.L., and Faires, J.D., "Numerical Analysis – Theory and Applications", Cengage Learning, India Edition, New Delhi, 2010, ISBN-13-9788131510858.
4. Jain M. K., Iyengar S. R., Kanchi M. B., Jain , "Computational Methods for Partial Differential Equations", New Age Publishers, 2016, ISBN-13: 978-8122439731.
5. Morton K.W. and Mayers D.F., "Numerical solution of partial differential equations",Cambridge University press, Cambridge, 2014,ISBN-13: 978-1107447462.

Course Code	**P15END102**	L	T	P	C
Course Name	**COMPUTER APPLICATIONS IN DESIGN**	3	0	0	3

Pre-requisite subjects: Engineering Graphics, CAD/CAM/CIM, Design of Machine Elements and Design of Jigs, Fixtures, Press tools and Moulds.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Impart knowledge on parametric sketching
CO2	Practice modeling, assembly, tolerance analysis of Mechanical components
CO3	Design Rapid tooling in computers
CO4	Impart knowledge on visual basic, pro/program, script, LISP etc
CO5	Provide standardization and design optimization for geometry.

Unit I INTRODUCTION TO COMPUTER APPLICATIONS IN NEW PRODUCT DESIGN L 9 T 0

Concept design – parametric sketching – constraints – computer graphics principles- 2D transformation, scaling, rotation – windowing, view ports – clipping – data exchange formats.

Unit II COMPUTERS IN DESIGN L 10 T 0

Solid modeling of Mechanical components – associative features – Sheet metal components, nesting and development – plastic parts with draft and shrinkage allowance – Reverse engineering of components – assembly of parts – tolerance analysis – mass property calculations

Unit III COMPUTERS IN TOOLING DESIGN L 9 T 0

Mould design – jigs and fixtures design – check for interferences – mechanism design and analysis – Rapid tooling

Unit IV COMPUTERS IN DESIGN PRODUCTIVITY L 8 T 0

Customizing various software by using visual basic, pro/program, script, LISP etc to write applications like design of shafts, gears etc.

Unit V MANAGING PRODUCT DESIGN DATA L 9 T 0

Version control – library creation – catalog making – standardization for design – collaborative design among peer groups – Design optimization for geometry - Design check, approval and validation.

Total: 45 Hrs

Content Beyond Syllabus

1. Basics of AUTOCAD
2. Interchangeability in Design
3. Design of Casting

Learning Resources

Reference Books

1. William M. Neumann and Robert Sproul " Principles of interactive Computer Graphics" Tata McGraw Hill Publishing Co. Ltd, 21st Reprint 2008,ISBN 13 –978-0-07-463293-2.
2. Ibrahim Zeid "CAD/CAM – Theory and Practice" – McGraw Hill, Special Indian Edition, Fifth reprint 2010 ISBN 13 – 978-0-07-015134-5.
3. P N Rao "CAD/CAM:Principles and Applications" Tata McGraw Hill Education Pvt Ltd, Third Edition. 2011, ISBN-13-978-0-07-068793-4
4. Schlechtendahl, E. G, CAD – Data transfer for Solid Models, Springer Verlag, Berlin, 1989, ISBN 9783540518266
5. Donald Hearn and M Pauline Baker "Computer Graphics" Prentice Hall Inc, Second Edition, 2002,ISBN-13: 978-8177587654

Course Code	**P15END103**	L	T	P	C
Course Name	**FINITE ELEMENT ANALYSIS**	3	2	-	4

Pre-requisite subjects: Engineering Mathematics, Numerical Methods, Strength of Materials Heat and mass transfer and Finite Element Analysis

Course Outcomes

Upon completion of this course the students will be able to

CO1	Provide further Advanced FEA knowledge and techniques for solving 1D complex problems in engineering.
CO2	Gain Knowledge to solve two-dimensional problems
CO3	Provide Knowledge to expertise in basic elements, Iso-parametric elements
CO4	Impart Knowledge to structural dynamics applications
CO5	Understand non-linear problems and error estimates

Unit I INTRODUCTION & ONE-DIMENSIONAL PROBLEMS L 10 T 6

Relevance of finite element analysis in design - Variational principles and methods – Weighted-Integral statements – Weak formulations – Ritz method – Method of weighted residuals – Applications of FEA - Finite element modeling – Co-ordinates and shape functions - Potential energy approach – Galerkin's approach – One dimensional finite element models in Solid mechanics and Heat transfer – Finite element model for beams

Unit II TWO-DIMENSIONAL PROBLEMS L 10 T 6

Poisson equation – Laplace equation – Weak form – Element matrices for triangular and rectangular elements – Evaluation of integrals – Assembly – Axi-symmetric problems – Applications – Conduction and convection heat transfer - Torsional cylindrical member – Transient analysis - Theory of elasticity – Plane strain – Plane stress – Axi-symmetric problems – Principle of virtual displacement

Unit III ISOPARAMETRIC ELEMENTS L 8 T 6

Introduction – Bilinear quadrilateral elements – Quadratic quadrilaterals – Hexahedral elements - Numerical integration – Gauss quadrature – Static condensation – Load considerations – Stress calculations – Examples of 2D and 3D applications

Unit IV STRUCTURAL DYNAMICS APPLICATIONS L 9 T 6

Dynamic equations – Mass and damping matrices – Natural frequencies and modes – Reduction of number of DOF-response history – Model methods – Ritz vectors – Component mode synthesis – Harmonic response – Direct integration techniques – Explicit and implicit methods – Analysis by response spectra – Example problems

Unit V NON-LINEAR PROBLEMS & ERROR ESTIMATES L 8 T 6

Introduction – Material non-linearity – Elasto Plasticity – Plasticity – Visco plasticity – Geometric non-linearity – Large displacement – Error norms and convergence rates – H-refinement with adaptivity – adaptive refinement

Tutorials: 30 Hrs
Total : 75 Hrs

Content Beyond Syllabus

1. Two-dimensional mesh generation – advancing front method
2. Three-dimensional mesh generation – Delaunay triangulation
3. Coupled problems
4. Transient response by analytical procedures

Learning Resources

Reference Books

1. Reddy J.N., "An Introduction to the Finite Element Method", McGraw Hill, International Edition 2005, 3rd Edition, ISBN-13: 978-0070607415.
2. Logan D.L, "A First Course in the Finite Element Method", Fifth Edition, Cengage Learning, 2012, ISBN-13: 978-8131517307.
3. Robert Davis Cook, Davis S. Malkus, "Concepts and Applications of Finite Element Analysis", Wiley, John & Sons, Forth Edition 2007, ISBN-13: 978-8126513369.
4. Larry J.Segerlind, "Applied Finite Element Analysis", Second Edition, John Wiley, 2010, ISBN-13**:** 978-8126528806.
5. S.S.Rao, "The Finite Element Analysis in Engineering", Butterworth-Heinemann; 5th edition, 2010, ISBN-13: 978-1856176613.
6. Zienkiewicz, O.C. and Taylor, R.L., "The Finite Element Method", Sixth Edition, Butterworth – Heinemann, 2005, ISBN–0–7506-6320-0.

Course Code	P15END104	L	T	P	C
Course Name	CONCEPTS OF ENGINEERING DESIGN	3	-	-	3

Pre-requisite subjects: Finite element Analysis, CAD/CAM/CIM, Engineering materials and Metallurgy, Manufacturing Technology I & II, Product Quality Development.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Impart knowledge on design process
CO2	Gain knowledge on mathematical modelling, geometric modelling.
CO3	Understand material selection Chart, Pugh selection method, selection with computed aided databases
CO4	Develop knowledge on material processing and design
CO5	Understand and respond Environmental and safety issues.

Unit I THE DESIGN PROCESS L 8 T 0

The Design Process - need identification – Design requirements – Product Life Cycle – Morphology of Design steps of Product Design – Conceptual Design, Embodiment Design, detailed Design – Concurrent Engineering – CAD & CAM, Human factors in Design.

Unit II TOOLS IN ENGINEERING DESIGN L 9 T 0

Creativity and problem solving, Decision Theory, Modeling – Role of models in Engineering Design, Mathematical modeling, Geometric modeling, finite element modeling, Rapid Prototyping – Simulation Finite Difference method, Monte Carlo method – Optimization – Search methods, Geometric programming, Structural and shape optimization.

Unit III MATERIAL SELECTION AND MATERIALS IN DESIGN L 9 T 0

The Classification and properties of Engineering materials, material standards and specifications – Methods of material selection – Ashby Chart and method of weight factors, Derivation of material indices, Use of material selection Chart, Pugh selection method, selection with computed aided databases – Design for brittle fracture, Design for fatigue failure, Design for corrosion resistance, Designing with plastics.

Unit IV MATERIAL PROCESSING AND DESIGN L 9 T 0

Classification of manufacturing processes and their role in design, Factors determining the process selection, use of process selection chart and computerized database – Design for manufacturing, Design for forging and sheet metal forming, Design for casting, Design for machining, welding and assembly, design for residual stresses and heat – treatment

Unit V LEGAL, ETHICAL ENVIRONMENTAL AND SAFETY ISSUES IN DESIGN AND QUALITY ENGINEERING L 10 T 0

The origin of laws, Contracts, - Liability – Tort Law- Product Liability – Design aspects of product liability, Codes of ethics, solving ethical conflicts. Design for environment – Life Cycle assessment – Material recycling and remanufacture, Design for safety – Potential Dangers and Guidelines for design for safety, Design for reliability failure mode effect analysis, robust Design.

Total: 45 Hrs

Content Beyond Syllabus

1. Basic concept of design
2. Design procedures
3. Design application in industries
4. Basic quality concepts

Learning Resources

Reference Books

1. Dieter, George E, Engineering Design –"A materials and processing Approach", Paperback, McGraw Hill Higher Education, 5th International edition, 2012, ISBN-13: 9780071326254.

2. Karl T. Vlrich and Steven D. Eppinger "Product design and Development", McGraw Hill, International Edition, 5th Edition,2000,ISBN: 0073404772
3. PahlgandBeitz W "Engineering Design" Springer – London,3rd Edition, 2006,ISBN-13: 9781846283185
4. Suh. N. P. "The principles of design",Oxford University Press USA 1990, ISBN-13: 9780195043457
5. Ray M.S. "Elements of Engineering Design", Printice Hall Inc.,1st Edition, 1985,*ISBN*-13: 9780132641852

		L	T	P	C
Course Code	**P15END105**				
Course Name	**MICRO ELECTRO MECHANICAL SYSTEMS DESIGN**	3	-	-	3

Pre-requisite subjects: Engineering Physics, Engineering Chemistry, Mechatronics, Strength of Materials, Dynamics of Machinery and Engineering Materials and Metallurgy.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Make scale up and scale down the physical quantities of micro system
CO2	Impart knowledge on MEMS with their manufacturing techniques
CO3	Impart knowledge on micromechanics
CO4	Describe packaging techniques of MEMS
CO5	Design micro systems in various applications like automotive industry, bio-medical etc.

Unit I INTRODUCTION L 9 T 0

Overview-Microsystems and microelectronics - Working principle of Microsystems - micro actuation techniques-micro sensors-types-microactuators-types-micropump-micromotors-micro-valves-microgrippers-scaling laws-scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity- scaling in fluid mechanics- scaling in heat transfer

Unit II MATERIALS AND FABRICATION PROCESS L 9 T 0

Substrates and wafer-single crystal silicon wafer formation-ideal substrates-mechanical properties-silicon compounds - Sio_2, SiC, Si_3N_4 and polycrystalline silicon - Silicon piezoresistors - Gallium aresenside, Quartz-piezoelectric crystals-polymers for MEMS - conductive polymers – Photolithography - Ion implantation - Diffusion – Oxidation – CVD - Physical vapor deposition - Deposition by epitaxy - etching process

Unit III MICROMECHANICS L 9 T 0

Introduction-static bending of thin plates-circular plates with edge fixed - rectangular plate with all edges fixed and square plate with all edges fixed – Mechanical vibration-resonant vibration- micro accelerometers-design theory and damping coefficients-thermo mechanics-thermal stresses-fracture mechanics-stress intensity factors, fracture toughness and interfacial fracture mechanics.

Unit IV MICRO SYSTEM MANUFACTURING L 9 T 0

Clean room technology-Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing

Unit V MICRO SYSTEM DESIGN L 9 T 0

Design considerations-process design-mask layout design- mechanical design-applications of micro system in -automotive industry-bio medical –aero space-telecommunications

Total : 45 hrs

Content Beyond Syllabus

1. Micro Gyroscope
2. Micro robots
3. Sensors used in Aircraft control panels

Learning Resources

Reference Books

1. Mohamed Gad-el-Hak, "The MEMS Hand book", First Edition, CRC press 2001, ISBN13-978-0849300776.
2. Julian W.Gardner, Vijay K.Varadan, Osama O.AwadelKarim, "Microsensors MEMS and Smart Devices", John Wiey& sons Ltd.,2013, ISBN-13: 978-8126540822
3. SergejFatikow, Ulrich. Rembold, "Microsystem Technology and Microrobotics", Springer-Verlag Berlin Heidelberg, 1997, ISBN-13: 978-3642082320.
4. Tai-Ran Hsu, "MEMS & Microsystems Design and Manufacture", International Edition, Tata McGraw-Hill, 2002, ISBN-13**:** 978-0070487093.
5. Francis E.H Tay and W.O Choong, "Microfludics and BioMEMS Applications", Springer US, 2011, ISBN-9781441953162.

		L	T	P	C
Course Code	**P15END501**				
Course Name	**RAPID PROTOTYPING AND TOOLING**	3	-	-	3

Pre-requisite subjects: Manufacturing Technology – I , Manufacturing Technology – II, CAD / CAM / CIM and Unconventional Machining Process.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Describe exhaustive knowledge in RPT Tooling
CO2	Impart knowledge in stereolithography systems selective laser sintering
CO3	Describe fusion deposition modeling
CO4	Provide Knowledge in laminated object manufacturing
CO5	Apply concepts of RPT in component development

Unit I INTRODUCTION L 8 T 0

Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Unit II STEREOLITHOGRAPHY SYSTEMS L 9 T 0

Principle, Process parameters, Process details, Data preparation, Data files and Machine details, Applications. SELECTIVE LASER SINTERING **-** Types of machines, Principle of operation, Process parameters, Data preparation for SLS, Applications.

Unit III FUSION DEPOSITION MODELING L 9 T 0

Principle, Process parameters, Path generation, Applications. SOLID GROUND CURING: Principle of operation, Machine details, Applications.

Unit IV LAMINATED OBJECT MANUFACTURING L 9 T 0

Principle of operation, LOM materials, Process details, Applications. CONCEPT MODELERS - Principle, Thermo jet printer, Sander's model market, 3-D printer, GenisysXs printer, JP system 5, Object Quadra System. LASER ENGINEERED NET SHAPING (LENS) – principle –applications.

Unit V RAPID TOOLING SOFTWARE FOR RAPID PROTOTYPING L 10 T 0

Indirect Rapid Tooling - Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, etc. Direct Rapid Tooling - Direct AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, ProMetal, Sand casting tooling, Laminate tooling, soft tooling vs hard tooling. STL files, Overview of Solid view, Magics, mimics, magics communicator, etc. Internet based softwares, Collaboration tools. RAPID MANUFACTURING PROCESS OPTIMIZATION - Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of part build orientation. ALLIED PROCESSES - Vacuum Casting, Surface Digitizing, Surface Generation from point cloud, Surface modification, data transfer to solid models.

Total : 45Hrs

Content Beyond Syllabus

1. Laser 3D printing
2. Smart materials used in RPT
3. Advanced Treatment for cleaning the prototypes

Learning Resources

Reference books

1. Paul. F. Jacobs, "Stereo lithography and other RP & M Technologies", Society of Manufacturing Engineers, NY, 1996, ISBN-9780872634671.
2. Pham. D. T. &Dimov. S. S., "Rapid Manufacturing", Springer, 2001, ISBN-9781852333607
3. Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs. "Rapid Tooling: Technologies and Industrial Applications", Marcel Dekker, Inc, 2003, ISBN-0824741595.
4. Terry Wohlers,"Wohlers Report 2006",Wohlers Associates, 2006, ISBN 0-9754429-2-9
5. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", World Scientific Publishing Company; 3 Har/Dvdr edition (January 14, 2010), ISBN-13: 978-9812778970

		L	T	P	C
Course Code	**P15END106**				
Course Name	**CAD LABORATORY**	-	-	4	2

Pre-requisite subjects: Machine Drawing and CAD laboratory

Course Outcomes

Upon Completion of this course the students will be able to

CO1	Understand the basic concepts of modeling and analysis softwares like PRO-E / SOLID WORKS /SOLID EDGE/CATIA / NX / ANSYS / NASTRAN etc.
CO2	Familiar with the sectioning concepts and drawing standards.
CO3	Develop part models by sketching.
CO4	Assemble part models into an assembly.
CO5	Create detailed drawing of assembly to understand 2D views.

LIST OF EXPERIMENTS

1. Introduction to CAD and solid works
2. Study of Sectional views and types of keys
3. Study of drawing standards
4. Split muff coupling – Part, Assembly and Detail drawing
5. Protected type Flange coupling – Part, Assembly and Detail drawing
6. Pipe vice – Part, Assembly and Detail drawing
7. Screw jack – Part, Assembly and Detail drawing
8. Simple eccentric – Part, Assembly and Detail drawing
9. Universal coupling – Part, Assembly and Detail drawing
10. Plummer block – Part, Assembly and Detail drawing
11. Claw coupling – Part, Assembly and Detail drawing
12. Knuckle joint – Part, Assembly and Detail drawing
13. Bushed Pin type Flexible Coupling – Part, Assembly and Detail drawing
14. Oldham's coupling – Part, Assembly and Detail drawing
15. Machine Vice – Part, Assembly and Detail drawing

List of Equipments

1. Computer workstation 20
2. Software requirement
   (a) PRO-E /SOLID WORKS /SOLID EDGE/CATIA / NX / ANSYS / NASTRAN

Total :60 Hrs

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Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END201	Mechanical Vibrations	5	0	0	5
2	P15END202	Integrated Product And Processes Development	5	0	0	5
3	P15END203	Advanced Mechanisms Design And Simulation	5	0	0	5
4	P15END204	Design For Manufacture And Assembly	5	0	0	5
5	P15END520	**Professional elective**-Industrial Robotics And Expert Systems	5	0	0	5
6	P15END523	**Professional elective**- Productivity Management And Re-Engineering	5	0	0	5
Practical						
7	P15END205	Analysis And Simulation Laboratory	0	0	6	3
					Total Credits	**33**

Approved by

Chairman, Mechanical Engineering BOS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

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HOD/MECH, Second Semester ME END Students and Staff, COE

Course Code	**P15END201**	L	T	P	C
Course Name	**MECHANICAL VIBRATIONS**	5	-	-	5

Pre-requisite subjects: Engineering Mechanics, Strength of materials, Kinematics and Dynamics of Machinery

Course Outcomes

Upon completion of this course the students will be able to

CO1	Understand fundamentals of vibrations and virtual work.
CO2	Gain knowledge on two degree freedom system, vibration absorber and isolator.
CO3	Impart knowledge on multi degree freedom system and numerical methods for fundamental frequencies.
CO4	Explain vibration of continuous systems like strings, rods and plates.
CO5	Provide the experimental methods in measuring vibration.

Unit I FUNDAMENTALS OF VIBRATION L 15 T 0

Introduction – Single degree freedom free vibration systems – Damped vibrations – Single degree freedom forced vibration with elastically coupled viscous dampers, System Identification from frequency response, Support motion, Duhamel's Integral – Impulse Response function – Virtual work – Lagrange's equation-– Transient Vibration

Unit II TWO DEGREE FREEDOM SYSTEM L 15 T 0

Free vibration of spring-coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration – Vibration Absorber – Vibration isolation.

Unit III MULTI-DEGREE FREEDOM SYSTEM L 15 T 0

Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – orthogonal properties – Modal matrix-Modal Analysis – Forced Vibration by matrix inversion – Modal damping in forced vibration – Numerical methods for fundamental frequencies.

Unit IV VIBRATION OF CONTINUOUS SYSTEMS L 15 T 0

Systems governed by wave equations – Vibration of strings – vibration of rods – Euler Equation for Beams – Effect of Rotary inertia and shear deformation – Vibration of plates.

Unit V EXPERIMENTAL METHODS IN VIBRATION ANALYSIS L 15 T 0

Vibration instruments – Vibration exciters Measuring Devices – Analysis – Vibration Tests – Free and Forced Vibration tests. Examples of Vibration tests – Industrial, case studies.

Total : 75Hrs

Content Beyond Syllabus

1. Basics mechanics
2. Basics of matrix

Learning Resources

Reference Books

1. Benson H.Tongue, Principles of Vibration, 2nd edn., Oxford University Press, NY, 2002 ISBN: 9780195142464
2. Thomson, W.T. – "Theory of Vibration with Applications", (5th Edition)CBS Publishers and Distributors, New Delhi, 1990. ISBN-13: 978-0136510680.
3. Rao, J.S., & Gupta, K. – "Ind. Course on Theory and Practice Mechanical Vibration", New Age International(P)Ltd.,1984.ISBN:978-81-224-1215-4 PublicationYear Edition:2nd Reprint : Aug, 2014
4. Den Hartog, J.P, "Mechanical Vibrations," Dover Publications, 4th Edition, 1990. ISBN 0-486-65407-9,
5. Rao, S.S.," Mechanical Vibrations," Addison Wesley Longman, 13th Edition, 1995. ISBN 13: 9780201065503

Course Code	P15END202	L	T	P	C
Course Name	INTEGRATED PRODUCT AND PROCESSES DEVELOPMENT	5	0	0	5

Pre-requisite subjects: Process planning and cost estimation, Concept of Engineering design, Industrial Management and Engineering.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Impart knowledge on product development processes and organizations.
CO2	Identify customer needs, product planning processes and allocating resources and timing.
CO3	Apply knowledge on product specifications.
CO4	Define the concept selection and measure customer response.
CO5	Provide product architecture and level design issues.

Unit I INTRODUCTION L 15 T 0

Characteristics of Successful Product Development-Interdisciplinary activity-Duration and Costs of Product Development- Challenges of Product Development -Development Processes and Organizations-A Generic Development Process-Concept Development: The Front-End Process Adapting the Generic Product Development Process- The AMF Development Process-Product Development Organizations-The AMF Organization

Unit II PRODUCT PLANNING L 15 T 0

Product Planning Process- Identifying Opportunities- Evaluating and Prioritizing Projects- Allocating Resources and Timing- Pre-Project Planning-Reflect on the Results and the Process-Identifying Customer Needs- Raw Data from Customers- Interpreting Raw Data in Terms of Customer Needs-Organizing the Needs into a Hierarchy-Establishing the Relative Importance of the Needs-Reflecting on the Results and the Process

Unit III PRODUCT SPECIFICATIONS L 15 T 0

Specifications - Specifications Established - Establishing Target Specifications-Setting the Final Specifications-Concept Generation-The Activity of Concept Generation-Clarify the Problem- Search Externally-Search Internally-Explore Systematically- Reflect on the Results and the Process.

Unit IV CONCEPT SELECTION L 15 T 0

Concept Selection- Overview of Methodology-Concept Screening-Concept Testing-Define the Purpose of the Concept Test- Choose a Survey Population- Choose a Survey Format- Communicate the Concept- Measure Customer Response-Interpret the Results-Reflect on the Results and the Process.

Unit V PRODUCT ARCHITECTURE L 15 T 0

Product Architecture-Implications of the Architecture-Establishing the Architecture-Delayed Differentiation-Platform Planning-Related System-Level Design Issues

Total: 75 Hrs

Content Beyond Syllabus

1. Supply chain mechanism
2. Cost estimation

Learning Resources

Reference Books

1. Product Design and Development, Karl T. Ulrich and Steven .D Epinger, McGraw-Hill International Edns. 4th edition 2013. ISBN-13: 978-0070658110
2. Kevien Otto and Kristin Wood, "Product Design" Pearson Publication,3rd Edition, 2012, ISBN-13: 9780130212719
3. Stuart Pugh, "Tool Design – Integrated Methods for successful Product Engineering", Addison Wesley Publishing, Neyork, 1991,ISBN: 020141639.
4. Stephen Rosenthal, Business One Orwin "Effective Product Design and Development", Homewood, 1992,ISBN:1-55623-603-4
5. KemnnethCrow,"ConcurrentEngg. /Integrated Product Development", DRM Associates, 26/3,ViaOlivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book.

Course Code	P15END203	L	T	P	C
Course Name	ADVANCED MECHANISMS DESIGN AND SIMULATION	5	-	-	5

Pre-requisite subjects: Engineering Mechanics, Industrial robotics, Kinematics and Dynamics of Machinery and Strength of Materials.

Course Outcomes

Upon completion of this course the students will be able to

CO1	• Review the fundamentals of kinematics and network formula.
CO2	Gain Knowledge to analyse simple and complex mechanisms.
CO3	Provide Knowledge to expertise in path curvature theory.
CO4	Impart Knowledge on synthesis of mechanisms and cam mechanisms.
CO5	Understand dynamics of mechanisms, special mechanisms and robotics.

Unit I INTRODUCTION L 15 T 0

Review of fundamentals of kinematics – mobility analysis – formation of one D.O.F. multi loop kinematic chains, Network formula – Gross motion concepts

Unit II KINEMATIC ANALYSIS L 15 T 0

Displacement, Velocity and acceleration analysis of simple mechanisms, instant centres kinematic analysis of complex mechanisms, Goodman analysis, auxiliary point method.

Unit III PATH CURVATURE THEORY L 15 T 0

Inflection point and inflection circles. Euler – Savary equation, Bobilliersconstructions , Hartmann's construction, the cubic of stationary curvature or Burmester's circle point and center point curves for four infinitesimally close positions of the moving plane.

Unit IV SYNTHESIS OF MECHANISMS L 15 T 0

Type synthesis – Number synthesis – Associated Linkage Concept. Dimensional synthesis – function generation, path generation, motion generation. Graphical methods. Cognate linkages -Coupler curve synthesis, design of six-bar mechanisms. Algebraic methods. Application of instant center in linkage design. Cam Mechanisms – determination of optimum size of Cams.

Unit V DYNAMICS OF MECHANISMS AND SPATIAL MECHANISMS AND ROBOTICS L 15 T 0

Static force analysis with friction – Inertia force analysis – combined static and inertia force analysis, shaking force, Kinetostatic analysis. Introduction to force and moment balancing of linkages.Kinematic Analysis of Spatial RSSR mechanism – Denavit – Hartenberg Parameters. Forward and inverse Kinematics of Robotic Manipulators.

Study and use of Mechanism using Simulation Soft-ware packages.

Total : 75 Hrs

Content Beyond Syllabus

1. Basics of Kinematics of machinery
2. Robotics

Learning Resources

Reference Books

1. Uicker, J.J, Pennock G.R. and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press, NY,4th Edition 2011. ISBN: 9780195155983
2. AmitabhaGhosh and Asok Kumar Mallik, "Theory of Mechanism and Machines", 3rd edition EWLP, Delhi, 1999.ISBN:978-81-8147-885-6 6
3. Sandor G.N., and Erdman A.G., "Advanced Mechanism Design Analysis and Synthesis", 1st Edition, Prentice Hall, 1984.ISB:1466570172
4. Nortron R.L., "Design of Machinery",3rd Edition McGraw Hill, 1999.ISBN-13: 978-0079097026
5. Kenneth J, Waldron, Gary L. Kinzel, "Kinematics, Dynamics and Design of Machinery", John Wiley-sons, 3rd Edition, 2004. ISBN: 978-0-471-24417-2

Course Code	**P15END204**	L	T	P	C
Course Name	**DESIGN FOR MANUFACTURE AND ASSEMBLY**	5	-	-	5

Pre-requisite subjects: Design of Machine Elements, Design of Jigs, fixtures, press tools and Moulds, CAD/CAM/CIM, Manufacturing Technology I & II, Product Quality Development and Concepts of Engineering design.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Impart knowledge on design principles for manufacturing.
CO2	Gain knowledge on form design and forgings.
CO3	Understand component design by considering machining.
CO4	Develop knowledge on component design by considering casting.
CO5	Understand and respond Environmental and safety issues for design.

Unit I INTRODUCTION L 15 T 0

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

Unit II FACTORS INFLUENCING FORM DESIGN L 15 T 0

Influence of materials on form design - form design of grey iron, malleable iron, steel and aluminium castings - form design of welded members, forgings.

Unit III COMPONENT DESIGN - MACHINING CONSIDERATION L 15 T 0

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

Unit IV COMPONENT DESIGN - CASTING CONSIDERATION L 15 T 0

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA.

Unit V DESIGN FOR THE ENVIRONMENT L 15 T 0

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

Total: 75 Hrs

Content Beyond Syllabus

1. Stress concentration
2. Basics of environmental engineering

Learning Resources

Reference Books

1. Boothroyd, G, "Design for Assembly Automation and Product Design", Marcel Dekker, NewYork., 2nd Edition, 2002 ISBN:0750673419
2. Bralla, "Design for Manufacture handbook", McGraw hill, 2nd Edition, 2013. ISBN-13: 9780070071391
3. Boothroyd, G, Heartz and Nike," Product Design for Manufacture", Marcel Dekker, 3rd Edition 1994.ISBN: 0-8247-0584-X.
4. Dickson, John. R, and Corroda Poly, "Engineering Design and Design for Manufacture and Structural Approach", Field Stone Publisher, USA, 1995.
5. Fixel, J. Design for the Environment McGraw hill.,2nd Edition,2011 ,ISBN-13: 978-0071776226
6. Graedel T. Allen By. B, "Design for the Environment", Angle Wood Cliff, Prentice Hall. Pearson Pub., 1996.ISBN-13 978-81-265-1336-9
7. Kevien Otto and Kristin Wood, "Product Design", Pearson Publication,2nd Edition, 2004.ISBN 7-302-07048-2

Course Code	**P15END520**	L	T	P	C
Course Name	**INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS**	5	-	-	5

Pre-requisite subjects: Kinematics and Dynamics of Machinery, Hydraulic and pneumatic systems, Mechatronics and Industrial robotics.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Understand robot kinematics and location of objects.
CO2	Impart knowledge on robot drives and controls.
CO3	Impart knowledge on robot sensors and training on vision systems.
CO4	Describe packaging techniques of MEMS
CO5	Design micro systems in various applications like automotive industry, bio-medical etc.

Unit I INTRODUCTION AND ROBOT KINEMATICS L 15 T 0

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – Classifications of Robots.

Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

Unit II ROBOT DRIVES AND CONTROL L 15 T 0

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

Unit III ROBOT SENSORS L 15 T 0

Transducers and Sensors – Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Gribbing – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system.

Unit IV ROBOT CELL DESIGN AND APPLICATION L 15 T 0

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

Unit V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPORT SYSTEMS L 15 T 0

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of Artificial Intelligence in Robots.

Total : 75 hrs

Content Beyond Syllabus

1. Parallel manipulator.
2. Mobile robot.
3. Bi-pedal robot.

Learning Resources

Reference Books

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee,"Robotics Control, Sensing, Vision and Intelligence",1st Edition McGraw Hill, 2013 .ISBN-13: 978-0070226258
2. YoramKoren," Robotics for Engineers' McGraw-Hill, 4th Edition 2013. ISBN 13: 9780070353992
3. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.ISBN : 5030008144.
4. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd.,2006 .2nd Edition , ISBN:8122418511
5. Deb, S.R." Robotics Technology and Flexible Automation", 3rd Edition, Tata McGraw-Hill, 1994. ISBN: 9780070077911
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", 4th Edition, McGraw-Hill, Int. 1986.ISBN-13: 9780070249899.
7. Timothy Jordanides et al ,"Expert Systems and Robotics ", Springer –Verlag, 3rd Edition, New York, May 1991.ISBN :9783642764677

Course Code	P15END523	L	T	P	C
Course Name	PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING	5	-	-	5

Pre-requisite subjects: Industrial Management and Engineering, Total Quality Management and Integrated product and process development.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Explain productivity concepts.
CO2	List productivity models and techniques.
CO3	Construct organizational transformation and re-engineering.
CO4	Explain re-engineering process improvement models.
CO5	Describere-engineering tools and implementation, re-opportunities and process redesign.

Unit I INTRODUCTION L 15 T 0

Productivity concepts - Macro and Micro factors of productivity, Productivity benefit model, productivity cycle.

Unit II PRODUCTIVITY MODELS L 15 T 0

Productivity measurement at International, National and Organizational level, Total productivity models. Productivity management in manufacturing and service sector. Productivity evaluation models, Productivity improvement models and techniques.

Unit III ORGANIZATIONAL TRANSFORMATION L 15 T 0

Principles of organizational transformation and re-engineering, fundamentals of process reengineering, preparing the workforce for transformation and reengineering, methodology, guidelines, DSMCQ and PMP model.

Unit IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS L 15 T 0

PMI models, Edosomwan model, Moen and Nolan strategy for process improvement, LMICIP model, NPRDC model.

Unit V RE-ENGINEERING TOOLS AND IMPLEMENTATION L 15 T 0

Analytical and process tools and techniques - Information and communication technology - Enabling role of IT, RE-opportunities, process redesign - cases. Software methods in BPR - specification of BP, case study - Order, processing, user interfaces, maintainability and reusability

Total : 75 hrs

Content Beyond Syllabus

1. Lean manufacturing.
2. SAP.
3. Line organization.

Learning Resources

Reference Books

1 Sumanth, D.J., " Productivity engineering and management ", TMH, New Delhi, 1990.
2 Edosomwan, J.A., "Organizational transformation and process re-engineering", British Library cataloging in pub. data, 1996.
3 Rastogi, P.N. "Re-Engineering and Re-inventing the enterprise ", Wheeler pub. New Delhi, 1995.
4 Premvrat, Sardana, G.D. and Sahay, B.S, "Productivity Management - A systems approach ", Narosa Pub. New Delhi, 1998.
5 Nick Obolensky "Practical Business Re-engineering: Tools and Techniques for Achieving Effective Change", Kogan Page, illustrated, reprint, 1996,ISBN:0749419652.

Course Code	P15END205	L	T	P	C
Course Name	ANALYSIS AND SIMULATION LABORATORY	-	-	6	3

Pre-requisite subjects: Machine Drawing and CAD laboratory, Analysis and simulation lab

Course Outcomes

Upon Completion of this course the students will be able to

CO1	Understand the basic concepts of modeling and analysis softwares like PRO-E / SOLID WORKS /SOLID EDGE/CATIA / NX / ANSYS / NASTRAN etc.
CO2	Familiar with the sectioning concepts and drawing standards.
CO3	Develop part models by sketching.
CO4	Assemble part models into an assembly.
CO5	Create detailed drawing of assembly to understand 2D views.

Analysis of Mechanical Components – Use of FEA Packages, like ANSYS/ NASTRAN etc., include FEA analysis of

i) Machine elements under static loads ,Heat transfer in mechanical systems
ii) Determination of natural frequency ,Axi-Symmetric elements
iii) Non-linear systems

Use of kinematics and dynamics simulation software like ADAMS software. Analysis of velocity and acceleration for mechanical linkages of different mechanisms.

LIST OF EXPERIMENTSTotal : 90 Hrs

1. Nodal Displacement of 1-D Bar
2. Displacement of Taper Plate
3. Displacement and Thermal Stress due to Static and Thermal
4. Nodal Displacement of Truss Member
5. Nodal Displacement of Thermal Stress due to Static and Thermal Load
6. Deflection of Beam Under UDL
7. Deflection of a Beam With Roller
8. Displacement and Von-Misses Stress Rectangular Plate Under Plane Stress
9. Displacement in a Thin Plane with a Circular Hole
10. Thermal Analysis of a Beam
11. Stress Analysis of an Axi-Symmetric Component
12. Model Analysis of a Cantilever-2D Plate
13. Structural Analysis of an L-Bracket
14. Harmonic Analysis of a Cantilever Beam
15. Heat Transfer in a Fin

List of Equipments

1. Computer workstation 20
2. Software requirement
   ANSYS / NASTRAN/ADAMS/MATLAB

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	P15END506	**Elective-** Mechanics Of Composite Materials	3	0	0	3
2	P15END521	**Elective-** Mechatronics System Design	3	0	0	3
3	P15END524	**Elective-** Product Data Management	3	0	0	3
Practical						
4	P15END301	Project Work Phase - I	0	0	12	6
					Total Credits	**15**

Approved by

Chairman, Mechanical Engineering BOS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/MECH, Third Semester ME END Students and Staff, COE

Course Code	P15END506	L	T	P	C
Course Name	MECHANICS OF COMPOSITE MATERIALS	3	-	-	3

Pre-requisite subjects: Engineering Materials and metallurgy, Engineering Mechanics, Manufacturing Technology – I & II

Course Outcomes

Upon completion of this course the students will be able to

CO1	To understand the basic of composite materials
CO2	To provide knowledge of simple stresses, strains and deformation due to external loads and their relations
CO3	To provide knowledge of simple stresses, strains and deformation due to external loads and their relations
CO4	To impart knowledge in orthotropic materials and their manufacturing.
CO5	To learn the design guidelines

Unit I INTRODUCTION L 9 T 0

Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Fiber surface treatments, Fillers and additives, Fiber content, density and void content.

Unit II MECHANICS L 9 T 0

Rule of mixture -volume and mass fractions – density - void content, Evaluation of four elastic moduli based on strength of materials approach and Semi-Empirical model-Longitudinal Young's modulus-transverse Young's modulus–major Poisson's ratio-In-plane shear modulus, Ultimate strengths of a unidirectional lamina. Characteristics of Fiber-reinforced lamina–laminates–lamination theory, Interlaminar stresses

Unit III PERFORMANCE L 9 T 0

Static Mechanical Properties – Fatigue and Impact Properties – Environmental effects – Long term properties, Fracture Behavior and Damage Tolerance.

Unit IV MANUFACTURING L 9 T 0

Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes – Quality Inspection methods. Processing of MMC –diffusion bonding – stir casting – squeeze casting.

Unit V DESIGN L 9 T 0

Failure Predictions, Laminate Design Consideration-design criteria-design allowables -design guidelines, Joint design-Bolted and Bonded Joints, Design Examples-Design of a tension member – design of a compression member – design of a beam-design of a torsional member, Application of FEM for design and analysis of laminated composites.

Total : 45 Hrs

Content Beyond Syllabus

1. Smart Materials
2. Performance study

Learning Resources

Reference books

1. Mallick, P.K., “Fiber Reinforced Composites: Materials, Manufacturing and Design”, Marcel Dekker Inc, 1993.
2. Autar K. Kaw, “Mechanics of Composite Materials” CRC Press, 2006
3. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, John Wiley and Sons, New York, 1990.
4. Ronald Gibson, “Principles of Composite Material Mechanics", Tata McGraw Hill, 1994.
5. Chawla K.K., “Composite materials”, Springer – Verlag, 1987

Course Code	P15END521	L	T	P	C
Course Name	MECHATRONICS SYSTEM DESIGN	3	-	-	3

Pre-requisite subjects: Mechatronics and Engineering Robotics

Course Outcomes

Upon completion of this course the students will be able to

CO1	Recall Mechatronics in products
CO2	Indentify various sensors and transducers
CO3	Demonstrate the microprocessor in various applications
CO4	Experiment the various program in PLC
CO5	Discuss the case study of Mechatronics system

Unit I INTRODUCTION L 9 T 0

Introduction to Mechatronics - Systems - Mechatronics in Products - Measurement Systems - Control Systems - Traditional design and Mechatronics Design.

Unit II SENSORS AND TRANSDUCERS L 9 T 0

Introduction - Performance Terminology - Displacement, Position and Proximity - Velocity and Motion - Fluid pressure - Temperature sensors - Light sensors - Selection of sensors - Signal processing - Servo systems.

Unit III MICROPROCESSORS IN MECHATRONICS L 9 T 0

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters –Applications - Temperature control - Stepper motor control - Traffic light controller.

Unit IV PROGRAMMABLE LOGIC CONTROLLERS L 9 T 0

Introduction - Basic structure - Input / Output processing - Programming -Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC.

Unit V DESIGN AND MECHATRONICS L 9 T 0

Designing - Possible design solutions - Case studies of Mechatronics systems.

Total : 45 hrs

Content Beyond Syllabus

1. System modeling.
2. Continues system.
3. Discrete system.

Learning Resources

Reference Books

1. Michael B.Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, A J., " Macaronis ", Chapman and Hall, 1993.
3. Ramesh.S, Gaonkar, " Microprocessor Architecture, Programming and Applications, "Wiley Eastern, 1998.
4. Lawrence J.Kamm,“Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ", Prentice-Hall, 2000.
5. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, “Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

Course Code	P15END524	L	T	P	C
Course Name	PRODUCT DATA MANAGEMENT	3	-	-	3

Pre-requisite subjects: Industrial Management and Engineering, Total Quality Management and Integrated product and process development.

Course Outcomes

Upon completion of this course the students will be able to

CO1	Explain software development in PDM
CO2	List the components of PDM
CO3	Construct Configuration Management
CO4	Demonstrate work flow and life cycle of products
CO5	List the configuration methods

Unit I INTRODUCTION L 9 T 0

Introduction to PDM-present market constraints-need for collaboration - internet and developments in server-client computing.

Unit II COMPONENTS OF PDM L 9 T 0

Components of a typical PDM setup-hardware and software-document management-creation and viewing of documents-creating parts-versions and version control of parts and documents-case studies.

Unit III CONFIGURATION MANAGEMENT L 9 T 0

Base lines-product structure-configuration management-case studies.

Unit IV PROJECTS AND ROLES L 9 T 0

Creation of projects and roles-life cycle of a product- life cycle management-automating information flow-work flows- creation of work flow templates-life cycle-work flow integration-case studies.

Unit V CHANGE MANAGEMENT GENERIC PRODUCTS AND VARIANTS L 9 T 0

Change issue- change request- change investigation- change proposal - change activity - case studies. Data Management Systems for FEA data - Product configurator - comparison between sales configuration and product configurator-generic product modeling in configuration modeler-use of order generator for variant creation-registering of variants in product register-case studies.

Total : 45 hrs

Content Beyond Syllabus

1. Basics of FEA
2. Cloud computing

Learning Resources

Reference Books

1. Kevin Otto, Kristin Wood, “Product Design”, Pearson, 2001.
2. Daniel Amor, “The E-Business Revolution”, Prentice-Hall, 2000.
3. David Bed worth. Mark Henderson & Phillip Wolfe. “Computer Integrated Design and Manufacturing “. McGraw Hill Inc...1991.
4. Terry Quatrain. “Visual Modeling with Rational Rose and UML “. Addison Wesley...1998.
5. Wind-Chill R5.0Reference Manuals...2000.

		L	T	P	C
Course Code	**P15END301**				
Course Name	**PROJECT WORK PHASE - I**	-	-	12	8

Pre-requisite subjects: Design of Machine Elements, Finite Element Analysis and Manufacturing Technology – I & II

Course Outcomes

Upon Completion of this course the students will be able to

CO1	Use their theoretical knowledge for understanding real situations
CO2	Use their skills to design / fabricate safe systems
CO3	Use various software packages to analyze the behavior and recommend appropriate remedies

OBJECTIVE:

It is proposed to carryout detailed design calculations and analysis of any mechanical Component or mechanical system. This helps the students to get familiar with respect to the design methodologies applied to any component or mechanical system subjected to static, dynamic and thermo-mechanical loads.

OUTCOME:

It helps the students to get familiarized with respect to design standards, design calculations, analysis in designing and fabricate any mechanical component or system.

Each student is required to select any new component or an integrated mechanical system that involves various sub components which are to be designed as per design standards and further required to be analyzed for optimum dimensions with respect to the strength and stiffness

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2015
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Practical						
1	P15END401	Project Work Phase – II	0	0	30	15
					Total Credits	**15**

Approved by

Chairman, Mechanical Engineering BOS
Dr.D.Senthilkumar

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/MECH, Fourth Semester ME END Students and Staff, COE