SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E-Mechanical Engineering

(Engineering Design)

CURRICULUM and SYLLABI

[For students admitted in 2022-2023]

M.E / M.Tech Regulation 2019

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	P19END101	Finite Element Analysis	3	0	0	3	45
2	P19END102	Computer Applications in Design	3	0	0	3	45
3	P19END103	Concepts of Engineering Design	3	0	0	3	45
4	P19END502	**Professional Elective:** Design for Manufacture and Assembly	3	0	0	3	45
5	P19END503	**Professional Elective:** Rapid Prototyping and Tooling	3	0	0	3	45
6	P19GE101	Research Methodology and IPR	2	0	0	2	30
7	P19GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	30
		Practical					
8	P19END104	CAD Laboratory	0	0	4	2	60
					Total Credits	**19**	

Approved by

Chairperson, Mechanical Engineering BOS   **Member Secretary, Academic Council**   **Chairperson, Academic Council & Principal**
Dr.D.Senthilkumar   **Dr.R.Shivakumar**   **Dr.S.R.R.Senthil Kumar**

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19END201	Mechanical Vibrations	3	0	0	3	45
2	P19END202	Integrated Product and Processes Development	3	0	0	3	45
3	P19END203	Design of Hydraulic and Pneumatic System	3	0	0	3	45
4	P19END523	**Professional Elective:** Product Data Management	3	0	0	3	45
5	P19END526	**Professional Elective:** Mechanics of Composite Materials	3	0	0	3	45
6	P19GE702	**Audit Course:** Stress Management By Yoga	2	0	0	0	30
Practical							
7	P19END204	Analysis and Simulation Laboratory	0	0	4	2	60
					Total Credits	**17**	

Approved by

Chairperson, 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, Second Semester ME END Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	P19END501	**Professional Elective** – IOT for Design & Manufacturing	3	0	0	3	45
2	P19END522	**Professional Elective** – Productivity Management and Re-Engineering	3	0	0	3	45
3	P19CEM601	**Open Elective** - Disaster Mitigation and Management	3	0	0	3	45
	P19PSE601	**Open Elective** - Smart Grid Technologies					
		Practical					
4	P19END301	Project Work Phase - I	0	0	16	8	240
					Total Credit	17	

Approved by

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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, Third Semester ME END Students and Staff, COE

10.07.2023

Regulations-2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Practical					
1	P19END401	Project Work Phase – II	0	0	28	14	420
		Total Credits				14	

Approved by

Chairperson, 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

22.12.2023

Regulations-2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19END101	Finite Element Analysis	3	0	0	3	45
2	P19END102	Computer Applications in Design	3	0	0	3	45
3	P19END103	Concepts of Engineering Design	3	0	0	3	45
4	P19END502	**Professional Elective:** Design for Manufacture and Assembly	3	0	0	3	45
5	P19END503	**Professional Elective:** Rapid Prototyping and Tooling	3	0	0	3	45
6	P19GE101	Research Methodology and IPR	2	0	0	2	30
7	P19GE701	**Audit Course:** English for Research Paper Writing	2	0	0	0	30
Practical							
8	P19END104	CAD Laboratory	0	0	4	2	60
					Total Credits	**19**	

Approved by

Chairperson, Mechanical Engineering BOS   Member Secretary, Academic Council   Chairperson, Academic Council & Principal
    Dr.D.Senthilkumar   Dr.R.Shivakumar   Dr.S.R.R.Senthil Kumar

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

Course Code	P19END101			L	T	P	C
Course Name	**FINITE ELEMENT ANALYSIS**			3	0	0	3

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, Isoparametric elements
CO4	Impart Knowledge to structural dynamics applications
CO5	Understand non linear problems and error estimates

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	3	2	2	3	3	2	2	2	3	3	3
CO – 2	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO – 3	3	3	3	3	3	3	3	3	2	3	2	3	3	2
CO – 4	3	2	3	2	3	2	3	3	3	3	3	3	2	3
CO - 5	3	2	3	3	2	2	3	3	3	3	3	3	3	3

Unit I   INTRODUCTION & ONE-DIMENSIONAL   L   9   T   -
PROBLEMS

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   9   T   -

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   9   T   -

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

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   9   T   -

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

Total   : 45 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 2018, 3rd Edition, ISBN-13: 978-0070607415.
2. Logan D.L, "A First Course in the Finite Element Method", Fifth Edition, Cengage Learning, 2015, ISBN-13: 978-8131517307.
3. Robert Davis Cook, Davis S. Malkus, "Concepts and Applications of Finite Element Analysis", Wiley, John & Sons, Forth Edition 2016, ISBN-13: 978-8126513369.
4. Larry J.Segerlind, "Applied Finite Element Analysis", Second Edition, John Wiley, 2014, ISBN-13**:** 978-8126528806.
5. S.S.Rao, "The Finite Element Analysis in Engineering", Butterworth-Heinemann; 5th edition, 2016, 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	**P19END102**			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.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	2	2	2	3	3	3
CO – 2	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO – 3	3	2	3	3	2	3	3	3	2	2	2	3	3	2
CO – 4	3	3	2	2	3	2	2	3	3	3	3	2	2	3
CO - 5	3	2	2	2	2	2	3	3	3	3	3	3	3	3

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   9   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   9   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 2015,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. 2016, 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, 2016,ISBN-13: 978-8177587654

Course Code	**P19END103**	L	T	P	C
Course Name	**CONCEPTS OF ENGINEERING DESIGN**	3	0	0	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.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak

Programme Outcomes (POs) and Programme Specific Outcome (PSOs)

COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	2	2	2	3	3	3
CO – 2	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO – 3	3	3	3	3	2	3	3	3	2	3	2	3	3	2
CO – 4	2	3	3	2	3	2	2	3	3	3	3	2	2	2
CO - 5	3	2	2	2	2	2	3	3	2	3	3	3	3	3

Unit I   THE DESIGN PROCESS   L   9   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   L   9   T   0
              DESIGN**
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   L   9   T   0
**   SAFETY ISSUES IN DESIGN AND QUALITY**
**   ENGINEERING**

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,2016, ISBN-13: 9780071326254.

2. Karl T. Vlrich and Steven D. Eppinger "Product design and Development", Mc Graw Hill, International Edition, 5th Edition,2014,ISBN: 0073404772

3. Pahlgand Beitz W "Engineering Design" Springer – London,3rd Edition, 2014,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

Course Code	**P19END502**			L	T	P	C
Course Name	**DESIGN FOR MANUFACTURE AND ASSEMBLY**			3	0	0	3

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.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 – Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	2	2	2	3	2	3
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CO – 4	3	3	3	2	2	2	2	3	2	3	3	2	2	3
CO - 5	3	2	2	2	2	2	3	3	3	3	3	3	3	3

Unit I INTRODUCTION L 9 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 9 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 9 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   9   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   9   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: 45 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, 2015 ISBN:0750673419

2.   Bralla, "Design for Manufacture handbook", McGraw hill, 2nd Edition, 2014. 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, 2015.

5.   Fixel, J. Design for the Environment McGraw hill.,2nd Edition,2015 ,ISBN-13: 978-0071776226

6.   Graedel T. Allen By. B, "Design for the Environment", Angle Wood Cliff, Prentice Hall. Pearson Pub., 2015. ISBN-13 978-81-265-1336-9

7.   Kevien Otto and Kristin Wood, "Product Design", Pearson Publication,2nd Edition, 2015. ISBN 7-302-07048-2

Course Code	P19END503		L	T	P	C
Course Name	**RAPID PROTOTYPING AND TOOLING**		3	0	0	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

<table>
<tr><td colspan="14">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak</td></tr>
<tr><td colspan="14">Programme Outcomes (POs) and Programme Specific Outcome (PSOs)</td></tr>
<tr><td>COs, POs & PSOs Mapping</td><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>PO9</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO - 1</td><td>3</td><td>2</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO – 2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO – 3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO – 4</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td></tr>
<tr><td>CO - 5</td><td>3</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
</table>

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, Genisys Xs printer, JP system 5, Object Quadra System. LASER ENGINEERED NET SHAPING (LENS) – principle –applications.

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

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   : 45 Hrs

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, 2016, ISBN-9780872634671.

2. Pham. D. T. & Dimov. S. S., "Rapid Manufacturing", Springer, 2017, ISBN-9781852333607

3. Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs. "Rapid Tooling: Technologies and Industrial Applications", Marcel Dekker, Inc, 2015, ISBN- 0824741595.

4. Terry Wohlers,"Wohlers Report 2006",Wohlers Associates, 2016, 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

Course Code	P15END104			L	T	P	C
Course Name	CAD LABORATORY			0	0	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, drawing standards and Develop part models by sketching.
CO3	Assemble part models and Create detailed drawing of assembly to understand 2D views.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	2	2	2	3	3	3
CO – 2	3	3	2	3	3	3	2	3	3	3	3	2	3	3
CO – 3	3	3	3	3	3	3	3	3	3	3	3	3	2	2

LIST OF EXPERIMENTS   Total : 45 Hrs

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 Equipment
1. Computer workstation 20
2. Software requirement
   CREO /SOLID WORKS /SOLID EDGE/CATIA / NX / NASTRAN

MECHANICAL ENGINEERING

M. E. / ENGINEERING DESIGN

SEMESTER – I	APPLIED PROBABILITY AND	L	T	P	C
P19END501	DIFFERENTIAL EQUATIONS	2	1	0	3

COURSE OUTCOMES

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

1. apply the concept of random variable and their properties to generate the moments.
2. fit the suitable distribution and its properties to the real world problems and interpret the results.
3. solve higher order ordinary differential equations by classical method.
4. solve partial differential equations by analytical methods.
5. apply the method of separation of variables, half range Fourier series and D' Alembert method to solve partial differential equations.

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PSO1	PSO2	
CO1	3		2	3							2		3	
CO2	3		2	3							2		3	
CO3	3		2	3							2		3	
CO4	3		2	3							2		3	
CO5	3		2	3							2		3	

UNIT – I   RANDOM VARIABLE   9

Random variable – Probability mass function, probability density function, moment generating function and their properties.

UNIT – II   STANDARD DISTRIBUTIONS   9

Binomial, Poisson, exponential and normal distributions and their properties– Function of a random variable.

UNIT – III   ORDINARY DIFFERENTIAL EQUATIONS   9

Linear higher order ordinary differential equations with constant coefficients – Method of variation of parameters.

UNIT – IV   PARTIAL DIFFERENTIAL EQUATIONS   9

Formation of partial differential equation – First order linear partial differential equations by Lagrange multiplier method – Partial differential equations solvable by direct integration.

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UNIT – V   APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   9

Solution of partial differential equations by method of separation of variables – Solution of one and two dimensional steady state heat flow equations by method of separation of variables and half range Fourier series – D' Alembert solution of one dimensional wave equation.

Theory: **30 Hours**   Tutorial: **15 Hours**   Total: **45 Hours**

TEXT BOOKS:

1. J. B. Doshi, "Differential Equations for Scientists and Engineers," Narosa Publishers, 1st Edition, Reprint, 2013.
2. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks", McGraw Hill Publishers, 4th Edition, 7th Reprint, 2018.

REFERENCE BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.
2. E. Kreyszig., "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
3. S. P. Gupta, "Statistical Methods", Sultan Chand and Sons Publishers, 15th Edition, 2012.

Prof. S. JAYABHARATHI
Head / Department of Mathematics
Sona College of Technology
Salem – 636 005

Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

10.05.2019   **M.E / M.Tech Regulations 2019**

COURSE OUTCOMES

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

1. Review the literature of the research problem
2. Choose appropriate data collection and sampling method according to the research problem.
3. Interpret the results of research and communicate effectively with their peers
4. Explain the Importance of intellectual property rights
5. Evaluate trade mark, develop and register patents

CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO12	PSO1	PSO2
CO1	3	3	3	3	2						3	3	3
CO2	3	3	3	3	2						3	3	3
CO3	3	3	3	3	2						3	3	3
CO4	3	3	3	3	2						3	3	3
CO5	3	3	3	3	2			3			3	3	3

UNIT I   INTRODUCTION TO RESEARCH METHODS   6

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design , Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules,

UNIT II   SAMPLING DESIGN AND HYPOTHESIS TESTING   6

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques - Testing of hypotheses concerning means (one mean and difference between two means - one tailed and two tailed tests), concerning variance – one tailed Chi-square test.

UNIT III   INTERPRETATION AND REPORT WRITING   6

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

UNIT IV   INTRODUCTION TO INTELLECTUAL PROPERTY   6

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.

16-09-2022

Dr. J. AKILANDESWARI
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005

M Tech Regulations 2019

5

UNIT V   TRADE MARKS, COPY RIGHTS AND PATENTS   6

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims –trademark Litigations- International trademark law

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

THEORY: 30 Hours   **TUTORIAL: -**   **PRACTICAL: -**   **TOTAL: 30 Hours**
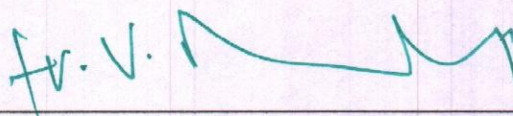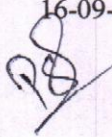
TEXT BOOKS

1. C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques ,4th Edition, New Age International Publishers, 2019.

2. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning, 4th Edition, 2012.

3. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata Mc Graw Hill Education, 1st Edition, 2008.

REFERENCE BOOKS

1. Panneerselvam, R., Research Methodology, Second Edition, Prentice-Hall of India, New Delhi, 2013.

2. Ranjith Kumar, Research Methodology – A step by step Guide for Begineers, 4th edition, Sage publisher, 2014.

3. D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1st Edition, 2016.

4. Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1st Edition, 2012.

5. Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1st Edition, 2017.

6. M.Ashok Kumar and Mohd.Iqbal Ali :"Intellectual Property Rights" Serials Pub

16-09-2022   **Dr. J. AKILANDESWARI**   M Tech Regulations 2019
PROFESSOR & HEAD
Department of Information Technology
SONA COLLEGE OF TECHNOLOGY
SALEM-636 005

P19GE701   **English for Research Paper Writing**

2 0 0 0

Course Outcomes:

At the end of the course, the students will be able to
- Demonstrate research writing skills both for research articles and thesis
- Frame suitable title and captions as sub-headings for articles and thesis
- Write each section in a research paper and thesis coherently
- Use language appropriately and proficiently for effective written communication
- Exhibit professional proof-reading skills to make the writing error free

Unit – I   6
Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness

Unit – II   6

Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections

of a paper/ abstract.

Unit- III   6

Key skills to frame a title, to draft an abstract, to give an introduction

Unit – IV   6

Skills required to organise review of literature, methods, results, discussion and conclusions

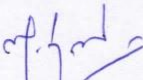**Unit – V**   6

Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Highman N , Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.
3. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
4. Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books)

REFERENCES

Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	P19END201	Mechanical Vibrations	3	0	0	3	45
2	P19END202	Integrated Product and Processes Development	3	0	0	3	45
3	P19END203	Design of Hydraulic and Pneumatic System	3	0	0	3	45
4	P19END523	**Professional Elective:** Product Data Management	3	0	0	3	45
5	P19END526	**Professional Elective:** Mechanics of Composite Materials	3	0	0	3	45
6	P19GE702	**Audit Course:** Stress Management By Yoga	2	0	0	0	30
		Practical					
7	P19END204	Analysis and Simulation Laboratory	0	0	4	2	60
					Total Credits	**17**	

Approved by

Chairperson, Mechanical Engineering BOS   **Member Secretary, Academic Council**   **Chairperson, Academic Council & Principal**
    Dr.D.Senthilkumar   **Dr.R.Shivakumar**   **Dr.S.R.R.Senthil Kumar**

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

Course Code	P19END201	L	T	P	C
Course Name	**MECHANICAL VIBRATIONS**	3	0	0	3

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.

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	3	2	2	3	3	2	2	2	3	2	3
CO – 2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 4	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO - 5	3	2	3	3	3	2	3	3	3	3	3	3	3	3

Unit I   FUNDAMENTALS OF VIBRATION   L   8   T   3

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   8   T   3

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   12   T   3

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   8   T   3

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   L   9   T   3
               ANALYSIS

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

Total   : 45 Hrs

Content Beyond Syllabus
1. Basics mechanics
2. Basics of matrix

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	**P19END202**	L	T	P	C
Course Name	**INTEGRATED PRODUCT AND PROCESSES DEVELOPMENT**	3	0	0	3

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.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	2	2	2	3	3	3
CO – 2	3	2	3	3	3	3	3	3	3	3	3	3	3	3
CO – 3	3	2	3	3	3	3	3	3	3	3	3	3	3	2
CO – 4	3	2	3	3	3	3	3	3	3	3	3	3	2	2
CO - 5	3	2	3	3	3	3	3	3	3	3	3	3	3	3

Unit I   INTRODUCTION   L   9   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   9   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   9   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   9   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   9   T   0

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

Total: 45 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. 7th edition 2020. 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, 2010,ISBN: 020141639.
4. Stephen Rosenthal, Business One Orwin "Effective Product Design and Development", Homewood, 1992,ISBN:1-55623-603-4
5. Kemnneth Crow,"Concurrent Engg. /Integrated Product Development", DRM Associates, 26/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book.

Course Code	P19END203	L	T	P	C
Course Name	DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	3	0	0	3

Pre-requisite subjects: Fluid mechanics, Hydraulic and pneumatics and Mechatronics

Course Outcomes

Upon completion of this course the students will be able to

CO1	To impart knowledge on hydraulic systems and its characteristics
CO2	To create expertise in control of pressure - direction and flow control valves
CO3	To gain knowledge of hydraulic equipment and to design hydraulic and electro-hydraulic systems for automation, pneumatic circuits.
CO4	To learn about pneumatic systems and circuits - cascade methods - mapping methods - step counter method
CO5	Plc, cascade, step counter and k-v mapping methods and to design low cost automation systems

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	3	2	3	3	3	3	3	3	3	3	3
CO – 2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 3	3	2	3	3	2	3	3	3	3	3	3	3	3	3
CO – 4	3	2	3	3	3	3	3	3	3	3	3	3	2	3
CO - 5	3	2	3	3	2	3	3	3	3	3	3	3	3	3

Unit I	**OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS**	L	9	T	0

Hydraulic Power Generators – Selection and specification of pumps, pump characteristics- Determination of volumetric, mechanical and overall efficiencies of positive displacement pumps. Linear and Rotary Actuators – selection, specification and characteristics.

Unit II	**CONTROL AND REGULATION ELEMENTS**	L	9	T	0

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems. Electrical control solenoid valves, relays, Electro hydraulic servo valves.

Unit III	**HYDRAULIC CIRCUITS**	L	9	T	0

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.

Unit IV	**PNEUMATIC SYSTEMS AND CIRCUITS**	L	9	T	0

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

Unit V	**INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS**	L	9	T	0

Pneumatic equipments- selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

Total   : 45 Hrs

Content Beyond Syllabus
1. PLC programming
2. SCADA

Learning Resources

Reference books

1. Bolton. W., "Pneumatic and Hydraulic Systems ", Butterworth –Heinemann, 1997.
2. Antony Espossito, "Fluid Power with Applications", Prentice Hall, 1980.
3. Dudleyt, A. Pease and John J. Pippenger, Industrial Hydraulics, Tata MGraw Hill Prentice Hall, 1985.
4. Andrew Parr, "Hydraulic and Pneumatics" (HB), Jaico Publishing House, 2004.
5. Majumdar, S.R., Oil Hydraulic Systems, Principles and Maintenance, Tata MGraw Hill Prentice Hall, 2001.

Course Code	**P19END523**	L	T	P	C
Course Name	**PRODUCT DATA MANAGEMENT**	3	0	0	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

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	3	2	2	2	3	2	2	2	3	2	2
CO – 2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 3	3	2	3	3	3	3	3	3	3	3	3	3	3	3
CO – 4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO - 5	3	2	3	3	3	3	3	3	3	3	3	3	3	3

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   L   9   T   0
**   VARIANTS**

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.

Course Code	**P19END526**	L	T	P	C
Course Name	**MECHANICS OF COMPOSITE MATERIALS**	3	0	0	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

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	2	2	2	2	2	3	3	3	2	2	2	3	2	2
CO – 2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO – 4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO - 5	3	3	3	3	3	2	3	3	3	3	3	3	3	3

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, 2007.
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	**P19END204**	L	T	P	C
Course Name	**ANALYSIS AND SIMULATION LABORATORY**	0	0	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 ANSYS / NASTRAN/ADAMS/MATLAB
CO2	Familiar with the meshing concepts and boundary conditions.
CO3	Know the solutions under various conditions.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	2	3	2	2	2	3	3	3	2	3	3	3	3
CO – 2	2	3	2	3	3	3	2	3	3	3	2	3	3	3
CO – 3	3	3	3	3	3	3	3	3	2	3	2	3	3	3

Analysis of Mechanical Components – Use of FEA Packages, like ANSYS/ NASTRAN etc., Exercises sh
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 EXPERIMENTS
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

Total : 60 Hrs

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

P19GE702   **Stress Management by Yoga**

2 0 0 0

Course Outcomes:

At the end of completion of this course, students will be able to
1. Develop physical and mental health thus improving social health
2. Increase immunity power of the body and prevent diseases
3. Accelerate memory power
4. Achieve the set goal with confidence and determination
5. Improve stability of mind, pleasing personality and work with awakened wisdom

UNIT – I   6

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do`s and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga- Nadi suthi, Practice and Spinal Sclearance Practice- Regularization of breathing techniques and its effects-Practice and kapalapathy practice.

UNIT – II   6

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice- Body relaxation practice and its benefits- Raja Yoga- 1.Agna – explanation and practice- Activation of Pituitary- Raja Yoga- 2. Santhi Yoga-Practice-Balancing of physical and mental power.

UNIT – III   6

Raja Yoga- 3. Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theory- Kayakalpa –practice-Yogic exercise to improve physical and mental health and practice-Asanas –explanation-Practice-benefits

UNIT –IV   6

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana,chakrasana, viruchasana etc-Stress management with Yoga-Role of women and Yoga

Equality, nonviolence, Humanity, Self- control- Food and yoga Aware of self-destructive habits

Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice

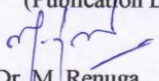**UNIT – V**   6

Moralisation of Desire & practice- Punctuality-Love-Kindness-Compassion Eradication of worries-Practice -Personality development, positive thinking-Good characters to lead a moral life

How to clear the polluted mind- Benefits of blessing- Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

Reference Books

1. 'Yogic Asanas for Group Tarining-Part-I" Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama
   (Publication Department), Kolkata

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	P19END501	**Professional Elective** – IOT for Design & Manufacturing	3	0	0	3	45
2	P19END522	**Professional Elective** – Productivity Management and Re-Engineering	3	0	0	3	45
3	P19CEM601	**Open Elective** - Disaster Mitigation and Management	3	0	0	3	45
	P19PSE601	**Open Elective** - Smart Grid Technologies					
		Practical					
4	P19END301	Project Work Phase - I	0	0	16	8	240
					Total Credit	17	

Approved by

Chairperson, 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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10.07.2023

Regulations-2019

SONA COLLEGE OF TECHNOLOGY
(Autonomous)
POST GRADUATE PROGRAMME
Branch: M.E. - ENGINEERING DESIGN
SYLLABUS AND CURRICULUM
Regulation – 2019

III - SEMESTER (FULL TIME)

S.No	Course Code	Course Title	L	T	P	C	Group Code	Total Contact Hours
		THEORY						
1	P19END501	Elective - IOT for Design and Manufacturing	3	0	0	3	PE	45
2	P19END522	Elective - Productivity Management and Re-Engineering	3	0	0	3	PE	45
3	P19CEM601	Open Elective – Disaster Mitigation and Management	3	0	0	3	OE	45
	P19PSE601	Open Elective - Smart Grid Technologies						
		PRACTICAL						
4	P19END301	Project Work Phase - I	0	0	16	8	C	240
		Total	9	0	16	17		

Dr. D. SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

10-07-2023

Regulation 2019

Course Code	**P19END501**										L	T	P	C
Course Name	**IOT FOR DESIGN AND MANUFACTURING**										3	0	0	3

Pre-requisite subjects: Engineering Mechanics, Design of Machine Elements, Manufacturing Technology – I & II

Course Outcomes

Upon completion of this course the students will be able to

CO1	To understand the basics of IOT
CO2	To create expertise on smart design and tools
CO3	Analysis of manufacturing process in three dimensions
CO4	Compare on various applications and facilities
CO5	Evaluate the workers with smart training

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1		1	1										1	
CO – 2		1	3	2	3	1	2	1	2			2	3	2
CO – 3		1	1	1	2	1	2	1	2	1		2	2	1
CO – 4		1			2	1		1	2			2	2	1
CO - 5		1			2	2		1	2	1	1	2	1	

Unit I	**INTERNET OF THINGS AND DEVICES**	L	9	T	0

An overview –Design Principles for Connected Devices -Internet Principles - Thinking about Prototyping – Costs versus ease of prototyping, prototyping and Production, open source versus Closed Source. Basics of Prototyping Embedded devices – Real Time Reactions, Other Protocols. Prototyping online Components – Automatic Storage Management – Introduction to Internet of Things Privacy, Security and Governance

Unit II	**SMART ENGINEERING DESIGN**	L	9	T	0

Smart Design- Digital Tools, Product Representation and Exchange Technologies and Standards, Agile (Additive) Manufacturing Systems and Standards. Mass Customization, Smart Machine Tools, Robotics and Automation (perception, manipulation, mobility, autonomy), Smart Perception – Sensor networks and Devices.

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| Unit III | SMART MANUFACTURING PROCESS | L | 9 | T | 0 |

Introduction to Smart Manufacturing - really and how does it differ from conventional/legacy manufacturing-Smart Manufacturing Processes- Three Dimensions: Demand Driven and Integrated Supply Chains - Dynamically Optimized Manufacturing Enterprises - Real Time - Sustainable Resource Management

| Unit IV | SMART APPLICATIONS | L | 9 | T | 0 |

Online Predictive Modeling, Monitoring and Intelligent Control of Machining/Manufacturing and Logistics/Supply Chain Processes; Smart Energy Management of manufacturing processes and facilities

| Unit V | SMART TRAINING FOR WORKERS | L | 9 | T | 0 |

Eliminating Errors and Omissions, Deskilling Operations, Improving Speed/Agility, Improving Information Capture -Traceability, Improving Intelligent Decision Making under uncertainty Assisted - Augmented Production, Assisted - Augmented Assembly, Assiste -Augmented Quality, Assisted -Augmented Maintenance, Assisted - Augmented Warehouse Operations and Assisted Training.

Total   : 45 Hrs

Content Beyond Syllabus

1. Cloud interface
2. Data analysis from cloud and reporting

Learning Resources
Reference books

1. A V L N Sujith , T S Santeep, G Sunil kumar "A Beginners Guide to Internet of Things" Publisher: Notion Press - 2017
2. Raj kamal, "Internet of Things - Architecture and Design Principles" McGraw Hill Education India, 2018
3. A. McEwen and H. Cassimally, Designing the Internet of Things, 1st edition, Wiley, 2013, ISBN-10: 111843062X.
4. N. Vengurlekar and P. Bagal, Database Cloud Storage: The Essential Guide to
5. Oracle Automatic Storage Management, 1st edition, McGraw-Hill Education, 2013, ISBN-10: 0071790152.
6. M. Kuniavsky, Smart Things: Ubiquitous Computing User Experience Design, 1st edition, Morgan Kaufmann, 2010, ISBN-10: 0123748992.

Dr. D.SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

10-07-2023

Regulation 2019

Course Code	P19END522		L T P C

Course Name	PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING	3 0 0 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 productivity concepts.

CO2 List productivity models and techniques.

CO3 Construct organizational transformation and re-engineering.

CO4 Explain re-engineering process improvement models.

CO5 Describe re-engineering tools and implementation, re-opportunities and process redesign.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1						1	1						1	
CO – 2				1	2					1	1	2	2	1
CO – 3			1		2	2	1	1	2	3	3	2	3	
CO – 4			1		3				2	1	2	1	3	1
CO - 5			1	1	3				2	1	2	1	3	1

Unit I	INTRODUCTION	L 9 T 0

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

Unit II	PRODUCTIVITY MODELS	L 9 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.

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Dr. D. SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

Unit III   ORGANIZATIONAL TRANSFORMATION   L   9   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   9   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   9   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 : 45 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.

10-07-2023

Dr. D. SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5

Regulation 2019

Course Code	P19END301	L	T	P	C
Course Name	PROJECT WORK PHASE - I	0	0	16	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

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3 – Strong, 2 – Medium, 1 - Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs & PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO - 1	3	3	3	2				3	3			2	3	
CO – 2			3		3	3	3				3	3	3	
CO – 3				3	3					3		2		3

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.

10-07-2023

Dr. D. SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5

Regulation 2019

P19CEM601	DISASTER MITIGATION AND MANAGEMENT	3	0	0	3

COURSE OUTCOMES

Upon completion of this course, the student will be able to...

- CO1 Identify the types of hazards, vulnerability and micro zonation
- CO2 Explain the causes and effects of disasters
- CO3. Discuss the preparedness and forecasting the disasters
- CO4 Explain various post disaster activities
- CO5 Discuss the disaster management solutions from case studies

Unit 1 INTRODUCTION	9 Hrs.

.Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: causes and effects – measurements - earthquake zones India – vulnerability and micro zonation;- volcanic hazards

Unit –II CAUSES AND EFFECTS	9 Hrs.

Landslides : Causes and effects – landslide prone zones in India –Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Tsunami –Soil Erosion-Drought :Characteristics-Occurrence – Preventive measures

Unit –III PREPAREDNESS AND FORECASTING	9 Hrs.

Emerging approaches in Disaster Management- Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/forecasting& warning- Preparing disaster preparedness plan- Land use zoning- Disaster resistant house construction- Population reduction in vulnerable areas- Awareness

Unit –IV POST DISASTER ACTIVITIES	9 Hrs.

Emergency Stage - Rescue training for search & operation at national & regional level-Immediate relief- Assessment surveys- Post Disaster stage-Rehabilitation- Political Administrative Aspect- Social Aspect- Economic Aspect- Environmental Aspect- Mitigation - Role of Media - Monitoring Management- Preventive Measures- A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster& Disaster in Hills with particular reference to India -Ecological planning for sustainability & sustainable development in India-Sustainable rural development

Unit –V CASE STUDIES	9 Hrs.

Soft Solutions for Disaster Management - Case studies - Earthquake, volcano and landslide - Flood prone area analysis and management – risk assessment – cyclones and floods - Drought and desertification

	Total: 45 hrs.

Reference Books:

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
3. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi. 4. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.

COURSE OUTCOME:

After completion of the course, the student will be able to

- Understand the features of Smart Grid.
- Assess the role of automation in Transmission and Distribution
- Apply Evolutionary Algorithms for the Smart Grid and Distribution Generation.
- Analyze the impact of renewable DG in micro-grid and electric vehicles.
- Understand operation and importance of PMUs, PDCs, WAMS, Voltage and Frequency control in Micro Grids.

CO / PO, PSO Mapping													
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	1	1			2	2	1	1	1
CO2	3	2	1	2	3	1			2	2	1	1	1
CO3	3	2	1	2	3	1			2	2	1	1	1
CO4	3	2	1	2	3	1			2	2	1	1	1
CO5	3	2	1	2	3	3			2	2	1	1	1

UNIT I   INTRODUCTION TO SMART GRID   9

Introduction to Smart Grid - Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid.

UNIT II   SMART GRID ARCHITECTURE   9

Components and Architecture of Smart Grid Design – Review of the proposed architectures for Smart Grid. The fundamental components of Smart Grid designs – Transmission Automation – Distribution Automation – Renewable Integration

UNIT III   TOOLS AND TECHNIQUES FOR SMART GRID   9

Computational Techniques – Static and Dynamic Optimization Techniques – Computational Intelligence Techniques – Evolutionary Algorithms – Artificial Intelligence Techniques.

UNIT IV   DISTRIBUTION GENERATION TECHNOLOGIES   9

Introduction to Renewable Energy Technologies – Micro grids – Storage Technologies – Electric Vehicles and plug- in hybrids – Environmental impact and Climate Change – Economic Issues.

UNIT V   COMMUNICATION TECHNOLOGIES IN SMART GRID   9

Introduction to Communication Technology – Synchro - Phasor Measurement Units (PMUs) – Wide Area Measurement Systems (WAMS) - Introduction to Internet of things (IOT) - Applications of IOT in Smart Grid

Lecture: 45 Hours;   Tutorial: 00 Hours;   Total: 45 Hours

REFERENCE BOOKS:

1. Stuart Borlase, Smart Grids, Infrastructure, Technology and Solutions, CRC Press, 1e, 2013

2. Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e, 2013.

3. A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer Edition, 2e, 2017.

4. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Mechanical Engineering
Branch: M.E. Engineering Design

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Practical					
1	P19END401	Project Work Phase – II	0	0	28	14	420
		Total Credits				14	

Approved by

Chairperson, 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, Fourth Semester ME END Students and Staff, COE

22.12.2023

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