



# PANDIAN SARASWATHI YADAV ENGINEERING COLLEGE

(Approved by AICTE & Affiliated to Anna University, Chennai)

Madurai – Sivagangai Highway, Arasanoor, Thirumansolai Post, Sivagangai Dt. – 630 561, Tamilnadu  
Mobile : 9842102628, 7373002628 Email: info@psyec.edu.in Website : www.psyec.edu.in

City Office : 10, Pandian Saraswathi St, Sivagami Nagar, Narayanapuram, Madurai - 625 014. Telefax- 0452 2682338, Mobile : 98423-02628

## Lesson Plan

**Subject Code:** ME 8593

**Subject Name:** Design of Machine Elements

**Total hours:** 45

**Faculty Name:** Dr. S. Rajamuneeswaran

**Branch:** Mechanical Engineering

**Year/SEM:** III/V

**Objectives:** To understand the principals involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements

Unit No	Unit Description	Starting Date	Completed Date	No of Hours	Test Plan	
1	Steady Stresses and Variable Stresses in Machine Members	10.08.2022	22.08.2022	12	IT-1	Model Exam
2	Shafts and Couplings	23.08.2022	20.09.2022	12		
3	Temporary and Permanent Joints	21.09.2022	10.10.2022	12	IT-2	
4	Energy Storing Elements and Engine Components	11.10.2022	23.10.2022	12		
5	Bearings	24.10.2022	10.11.2022	12		

### **Text Books:**

1. Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

### **References:**

1. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill Book Co. (Schaum's Outline), 2010.
2. Ansel Ugural, "Mechanical Design – An Integral Approach", 1 st Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4 th Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam. N, "Machine Design", Anuradha Publications, Chennai, 2015.





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## Unit I

### STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level
1.	Introduction to the design process & factors influencing machine design	Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016	1	1	BBP	CO1	Remember
2.	Selection of materials based on mechanical properties		1	1	BBP	CO1	Remember
3.	Preferred numbers, Fits and Tolerances		1	1	BBP	CO1	Remember
4.	Direct, bending and torsional stress equations, Impact and shock loading		1	1	BBP	CO1	Remember
5.	Calculation of principle stresses, Eccentric loading		1	1	BBP	CO1	Analyze
6.	Design of curved beams , crane hook and 'C' frame		1	1	BBP	CO1	Analyze
7.	Factor of safety, Theories of failure, Stress concentration		1	1	BBP	CO1	Analyze
8.	Design for variable loading		1	1	BBP	CO1	Analyze
9.	Soderberg, Goodman and Gerber relations		1	1	BBP	CO1	Analyze
10.	Coaching /Revision				1		
11.	Test Hours				2		
	<b>Total</b>		<b>09</b>	<b>12</b>			





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## Unit II

### SHAFTS AND COUPLINGS

Sl.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Design of shafts subjected to bending	Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016	1	1	BBP	CO2	Analyze	
2.	Design of shafts subjected to twisting		1	1	BBP	CO2	Analyze	
3.	Design of shafts subjected to combined bending and twisting		1	1	BBP	CO2	Understand	
4.	Design of shafts subjected to fluctuating loads		1	1	BBP	CO2	Understand	
5.	Design of shafts based on rigidity		1	1	BBP	CO2	Analyze	
6.	Design of shafts subjected based on critical speed		1	1	BBP	CO2	Analyze	
7.	Design of keys, key ways and splines		1	1	BBP	CO2	Analyze	
8.	Design of crankshafts,		1	1	BBP	CO2	Analyze	
9.	Design of rigid & flexible couplings		1	1	BBP	CO2	Analyze	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit III

### TEMPORARY AND PERMANENT JOINTS

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Types of Threaded fasteners	Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016	1	1	BBP	CO3	Remember	
2.	Design of bolted joints		1	1	BBP	CO3	Analyze	
3.	Eccentric loaded bolted joints		1	1	BBP	CO3	Understand	
4.	Design of Knuckle joints		1	1	BBP	CO3	Understand	
5.	Design of Cotter joints		1	1	BBP	CO3	Analyze	
6.	Design of welded joints		1	1	BBP	CO3	Analyze	
7.	Design of riveted joints		1	1	BBP	CO3	Analyze	
8.	Design of riveted joint for structures &		1	1	BBP	CO3	Analyze	
9.	Theory of bonded joints		1	1	BBP	CO3	Remember	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit IV

### ENERGY STORING ELEMENTS AND ENGINE COMPONENTS

Sl.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Design of helical springs	Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016	1	1	BBP	CO4	Remember	
2.	Optimization of helical springs		1	1	BBP	CO4	Understand	
3.	Design of Leaf springs		1	1	BBP	CO4	Understand	
4.	Rubber springs		1	1	BBP	CO4	Understand	
5.	Energy stored in a flywheel,		1	1	BBP	CO4	Understand	
6.	Design of flywheel stresses in rims and arms		1	1	BBP	CO4	Apply	
7.	Design of shaft, hub and key		1	1	BBP	CO4	Apply	
8.	Flywheel for engines and punching machines		1	1	BBP	CO4	Apply	
9.	Energy stored in a flywheel		1	1	BBP	CO4	Remember	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit V

### BEARINGS

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Types of Sliding contact bearings	Bhandari V, "Design of Machine Elements", 4 th Edition, Tata McGraw-Hill Book Co, 2016	1	1	BBP	CO5	Understand	
2.	Design of hydrodynamic journal bearings - McKee's Equation		1	1	BBP	CO5	Analyze	
3.	Design of hydrodynamic journal bearings, Sommerfield Number		1	1	BBP	CO5	Understand	
4.	Design of hydrodynamic journal bearings		1	1	BBP	CO5	Understand	
5.	Raimondi & Boyd graphs		1	1	BBP	CO5	Understand	
6.	Types of rolling contact bearings		1	1	BBP	CO5	Understand	
7.	Selection of Rolling Contact bearings		1	1	BBP	CO5	Analyze	
8.	Design of Seals & Gaskets		1	1	BBP	CO5	Analyze	
9.	Design of Connecting Rod		1	1	BBP	CO5	Analyze	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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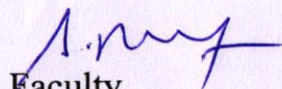
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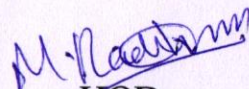
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Sl.No	Unit	No of hours as per Syllabus	No of hours as per Lesson Plan	Deviation	Reason for deviation: if any
1	I	9	12	3	More topics discussed
2	II	9	12	3	Explained Important Topics
3	III	9	12	3	Test and Revision conducted
4	IV	9	12	3	Explained Important Topics
5	V	9	12	3	Test and Revision conducted

## Assignment Details

SL. No	Assignment Titles
1	Soderberg, Goodman and Gerber relations
2	Design of crankshafts
3	Design of bolted joints
4	Design of Leaf springs
5	Design of Connecting Rod

  
Faculty

  
HOD

  
IQAC

  
Principal





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## Lesson Plan

**Subject Code: ME 8692**

**Subject Name: Finite Element Analysis**

**Total hours: 45**

**Faculty Name: Dr. S. Rajamuneeswaran**

**Branch: Mechanical Engineering**

**Year/SEM: III/VI**

**Objectives:** To impart knowledge the concepts of Mathematical Modelling of Engineering and use FEM in recent trends

Unit No	Unit Description	Starting Date	Completed Date	No of Hours	Test Plan	
1	Introduction	06.02.2023	23.02.2023	12	IT-1	Model Exam
2	One-Dimensional Problems	24.02.2023	06.03.2023	12		
3	Two-Dimensional Scalar Variable Problems	07.03.2023	25.03.2023	12	IT-2	
4	Two-Dimensional Vector Variable Problems	26.03.2023	15.04.2023	12		
5	Isoparametric Formulation	16.04.2023	14.05.2023	12	IT-3	

### **Text Books:**

1. Reddy, J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P., "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

### **References:**

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)
2. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.





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## Unit I

### Introduction

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Mathematical Modeling of field problems in Engineering, Governing Equations	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005	1	1	BBP	CO1	Analyze	
2.	Discrete and continuous models Boundary, Initial and Eigen Value problems		1	1	BBP	CO1	Remember	
3.	Weighted Residual Methods		1	1	BBP	CO1	Evaluate	
4.	Weighted Residual Methods		1	1	BBP	CO1	Evaluate	
5.	Weighted Residual Methods		1	1	BBP	CO1	Evaluate	
6.	Variational Formulation of Boundary Value Problems		1	1	BBP	CO1	Analyze	
7.	Ritz Technique		1	1	BBP	CO1	Analyze	
8.	Ritz Technique		1	1	BBP	CO1	Analyze	
9.	Basic concepts of the Finite Element Method		1	1	BBP	CO1	Understand	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit II

### ONE-DIMENSIONAL PROBLEMS

Sl.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	One Dimensional Second Order Equations, Discretization	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005	1	1	BBP	CO2	Understand	
2.	Element types, Linear and Higher order Elements		1	1	BBP	CO2	Analyze	
3.	Derivation of Shape functions and Stiffness matrices		1	1	BBP	CO2	Understand	
4.	Derivation of force vectors, Assembly of Matrices		1	1	BBP	CO2	Remember	
5.	Solution of problems from solid mechanics		1	1	BBP	CO2	Analyze	
6.	Solution of problems from solid mechanics		1	1	BBP	CO2	Analyze	
7.	Solution of problems from heat transfer		1	1	BBP	CO2	Analyze	
8.	Longitudinal vibration frequencies and mode shapes.		1	1	BBP	CO2	Understand	
9.	Fourth Order Beam Equation, Transverse deflections and Natural frequencies of beams		1	1	BBP	CO2	Understand	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit III

### TWO-DIMENSIONAL SCALAR VARIABLE PROBLEMS

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Second Order 2D Equations involving Scalar Variable Functions	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw- Hill, 2005	1	1	BBP	CO3	Understand	
2.	Variational formulation Finite Element formulation		1	1	BBP	CO3	Understand	
3.	Triangular elements, Shape functions		1	1	BBP	CO3	Understand	
4.	Triangular elements, element matrices and vectors		1	1	BBP	CO3	Understand	
5.	Application to Field Problems		1	1	BBP	CO3	Analyze	
6.	Application to Field Problems		1	1	BBP	CO3	Analyze	
7.	Thermal problems		1	1	BBP	CO3	Analyze	
8.	Torsion of Non circular shafts, Quadrilateral elements		1	1	BBP	CO3	Remember	
9.	Higher Order Elements.		1	1	BBP	CO3	Evaluate	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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## Unit IV

### TWO-DIMENSIONAL VECTOR VARIABLE PROBLEMS

Sl.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Equations of elasticity	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005	1	1	BBP	CO4	Remember	
2.	Derivation of Plane stress, plane strain and axisymmetric problems		1	1	BBP	CO4	Understand	
3.	Derivation of axisymmetric problems		1	1	BBP	CO4	Understand	
4.	Derivation of Body forces and temperature effects		1	1	BBP	CO4	Understand	
5.	Plane stress, plane strain and axisymmetric problems		1	1	BBP	CO4	Apply	
6.	Plane stress, plane strain and axisymmetric problems		1	1	BBP	CO4	Apply	
7.	Plane stress, plane strain and axisymmetric problems		1	1	BBP	CO4	Apply	
8.	Stress calculations - Plate elements		1	1	BBP	CO4	Apply	
9.	Stress calculations - Shell elements		1	1	BBP	CO4	Apply	
10.	Coaching /Revision				1			
11.	Test Hours				2			
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## Unit V

### ISOPARAMETRIC FORMULATION

S.No	Description	Reference Books	Hours as per Syllabus	Estimated hours	Mode of teaching	Course Outcome	Blooms Taxonomy level	
1.	Shape functions for iso parametric elements One and two dimensions	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005	1	1	BBP	CO5	Understand	
2.	Serendipity elements		1	1	BBP	CO5	Understand	
3.	Numerical integration		1	1	BBP	CO5	Understand	
4.	Numerical integration		1	1	BBP	CO5	Understand	
5.	Application to plane stress problems		1	1	BBP	CO5	Apply	
6.	Matrix solution techniques		1	1	BBP	CO5	Analyze	
7.	Solutions Techniques to Dynamic problems		1	1	BBP	CO5	Analyze	
8.	Introduction to Analysis Software.		1	1	BBP	CO5	Remember	
9.	Shape functions for iso parametric elements One and two dimensions		1	1	BBP	CO5	Understand	
10.	Coaching /Revision				1			
11.	Test Hours				2			
	<b>Total</b>		<b>09</b>	<b>12</b>				





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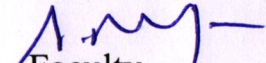
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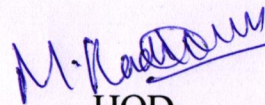
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Sl.No	Unit	No of hours as per Syllabus	No of hours as per Lesson Plan	Deviation	Reason for deviation: if any
1	I	9	12	3	More topics discussed
2	II	9	12	3	Explained Important Topics
3	III	9	12	3	Test and Revision conducted
4	IV	9	12	3	Explained Important Topics
5	V	9	12	3	Test and Revision conducted


## Assignment Details

SL. No	Assignment Titles
1	Basic concepts of the Finite Element Method
2	Linear and Higher order Elements
3	Higher Order Elements
4	Plane stress, plane strain and axisymmetric
5	Natural co-ordinate systems

  
Faculty

  
HOD

  
IQAC

  
Principal